

Aalto University  
School of Science  
Degree Programme in Computer, Communication and Information Science

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# Applicability of Design System to White-Label Service Development

Master's Thesis  
Espoo, Dec 30, 2019

|             |   |
|-------------|---|
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ABSTRACT OF  
 MASTER'S THESIS

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| <p>Design Systems are now widely recognised in industrial world as a system for designing digital products. Design systems have evolved in the intersection between art, technology and industry. They became quite trendy from the year 2016. Organisations have paved their pace of creation and innovation by creating their own design systems for designing and developing every small design their product consists of.</p> <p>The main objective of the thesis is to evaluate the applicability of design system in developing white-label services. The aim of the work also explored the opportunity to bring the novel concept of design system to a researchable topic. There is a need to bring a common standard for defining the structure of design system. The empirical work laying foundation for a set of guidelines and practices will eventually take the Design system to such level that it will facilitate work for White-Label services as well.</p> <p>The findings have reflected that defining the structure of design system and providing setup to create one has not solved the issues of designers and developers struggling with inconsistencies in user interfaces and communication gap between design and development environment. To understand this problem deeper and to bring solution, this thesis proposes a conceptual UX Framework from which practitioners can advance their organisation’s work and future practices. This framework facilitates to bring user experience and design more closer to development process resulting in development of usable, useful and enjoyable products and services.</p> |  |               |           |
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Chandni Sharma

# Abbreviations and Acronyms

|       |                                  |
|-------|----------------------------------|
| UX    | User Experience                  |
| GPR   | Generic Product Requirement      |
| SDK   | Software Development Kit         |
| R&D   | Research and Development         |
| DS    | Design System                    |
| WLS   | White Label service              |
| CSR   | Customer Service Representatives |
| CRM   | Customer Relationship Management |
| UCD   | User-centered design             |
| CX    | Customer Experience              |
| CSS   | Cascading Style Sheets           |
| UI    | User Interface                   |
| GUI   | Graphical User Interface         |
| LOB   | Lines of Business                |
| KPI   | Key Performance Indicator        |
| Telco | A Telecommunications Company     |

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“The etymology of design goes back to the latin de + signare and means making something, distinguishing it by a sign, giving it significance, designating its relation to other things, owners, users or gods.

Based on this original meaning, one could say: design is making sense (of things).” — Klaus Krippendorff, *Design Issues*, 1989  
Verganti (2004).

# Chapter 1

## Introduction

Design Systems are now widely recognised in industrial world as a system for designing digital products. They are more than the latest fad; a natural evolution in the intersection between art, technology, and industry (Vesselov and Davis, 2019). Design system became quite trendy from the year 2016. While design systems are becoming popular in small and large businesses, the concept existed from the 1960s (Ackoff, 1962). Organisations have paved their pace of creation and innovation by creating their own design systems for designing and developing every small design their product consists of (Fanguy, 2019).

Component-based development (Suarez et al., 2017), modular software solutions (Fanguy, 2018) and design patterns have been part of software development process. The revolution has begun when concepts of design, User Experience (UX), design thinking, UX design and more, gained recognition in the digital world dramatically. Although these concepts are impacting the software industry significantly, they are still taking time to establish their place in large enterprises. Understanding of these concepts are still missing the right mindset in large enterprises especially the engineering ones (Colin M et al., 2015). The concept of UX itself covers quite complex terms and it is quite challenging to make this fit into established practices and processes of organisations (Colville-Hyde, 2016). Ensuring and achieving consistency in User Experience drives companies to approach Design Systems. The User Experience perspective helps in aligning and supporting their teams with reusable components, guidelines and practices (Idean, 2019).

While software companies are trying to establish these concepts, another challenge falls at the same time. Developing a large software application involves many teams handling different units of the application. Compo-

nent re-usability and consistent user experience becomes a daunting situation when many teams work on building a large enterprise application. Information sharing, coordination and common understanding of design and development tasks is always having communication gaps. There have been consistent efforts in software industry to solve the issues like consistency and re-usability until recently when top leading companies like Google (Google, 2019), Airbnb (Schleifer, 2016), IBM (IBM, 2019), published their Design Systems.

Design systems have established more recognition in practitioner world. They have not achieved the maturity and quality standards yet. This brings challenges in overcoming the issues fully, as can be seen in the case study in the thesis. The empirical research in this thesis focuses on a multinational company with its Research and Development (R&D) centre in Finland. The company provides many products and services getting developed on many technologies using different platforms. The company has a centralised model where a dedicated team is responsible for contributing to the design system of the company with an effort to bring UX consistency throughout all its products. Additionally, every product has its UX team as well which follows the centralised repository of guidelines. If a new addition or change in existing design is needed then a long review process is involved. The centralised team has established rules, guidelines and processes towards the development of company's design system. The development of this design system started recently in the company. In parallel the company started development of a white-label service in a department in Finland's R&D centre.

This brings a unique need from industrial world perspective. The expectation of developing a white-label service is to provide coherent and consistent service for multiple customers in their brand name and requirements. Thus, managing style assets and components to create one service customised in customer's requirements. The main objective of the research is how to apply design system concept to white-label service development. Therefore, this study first focuses on understanding design systems and practices carried out in industries. It analyses from existing literature, how it has changed the scenario of consistency in applications. This is followed upon by analysing the applicability and scalability of design system to development of white-label service. Analysis and synthesis of the literature, supplemented with empirical data collected via an exploratory case study with a multinational company form the basis of a conceptual framework encompassing design system within is proposed in the thesis.

## Chapter 2

# Research Questions

As described above in Chapter 1, the company has central team developing the design system and the case department in Finland is developing a white-label service on different platform. The company asked researcher to research upon two folds.

The first part deals with the research on analysing the applicability and impact of the organisation's own design system to development of a white-labelled service. Considering the aforementioned problems of consistency in user interface and re-usability of components and patterns, this study researches about existing industry and academic knowledge of design system. This research uses the knowledge to analyse impact of design system in developing white-label service:

**Research Question 1: How can the vendor's own design system support the development of white-label services?**

This research question covers a vast research work and thus for simplification, the main research question has been fragmented as:

- 1a.** What does a design system consists of?
- 1b.** What practices and processes are included in design systems?
- 1c.** What are the benefits of a design system for white label services?

Through research around these questions, the thesis aims to develop an understanding on how the design system and development environment can

work in coordination. This is needed to achieve the user interface consistency by creating and contributing to reusable design and development assets. The answer to 1a, 1b was found through literature review presented in Chapter 3. The answer of 1c is comes from Chapter 5 and 6 and presented in conclusion in Chapter 8.

The second fold of the thesis work comes from the requirement put forward by case department of the company. The case department in Finland aims at having a distributed model of component library where various teams involved in the service development contribute in generating assets of the systems. They aspire to provide better support to developers through their system improving the developer experience and to bridge the gap between design and development teams. This forms the background behind the second research question.

**Research Question 2: What is the experience of developers in using a Design System?**

To provide modularity and simplification, the question is fragmented as follows:

- 2a.** How does a design system support developers in their work?
- 2b.** How to collaborate between design and development practices?

Answers to second research questions are discussed in conclusions in Chapter 8.

Thus, through academic and industrial knowledge on the basis of literature study, understanding of the state-of-the-art of design system is build. Further work builds upon how existing knowledge of design system can be applied to development of white-label service. During the applicability study of design system, it is evaluated for it's user experience to its customers, who are developers and designers using design system to create products and services.

## Chapter 3

# Review of the Literature

To describe the theoretical perspective, and to become well-informed about the state of the knowledge of Design System in academic and practitioner's perspective, a range of literature was explored (Muratovski, 2016).

The literature was reviewed in areas of design culture and design thinking, design systems and their adoption and impact on organisations. Literature was also explored studying about the experience of the design teams in organisations adopting or developing their own design system. More literature was studied on how the design system framework and practices fit for different products/services, different technologies and ways of working, and finally about the design system and white label service development.

As per the literature explored, the study will discuss briefly about importance of design (section 3.1), basic understanding on design system (section 3.2, 3.3) and how the companies got benefited using the design systems (section 3.4). As the thesis research has two-fold perspectives, the literature review will emphasise further on practices and processes of design system and development environment(section 3.5). A brief look at white label service concept is covered in section 3.6.

Because of the increasing popularity, large enterprises are investing in their business as well as R&D area to explore creating their own design system (Madsen, 2017). This thesis covers a similar case. The thesis work describes the components of design system from academic as well as industry perspective. The concept of components hold extensive review in academic literature. Although, design system include components as one of its assets

(discussed in section 3.4) but design system has not been researched academically yet to that extent. Case study of this work also reflects importance of components in development environment.

The research work aspires to bring more solid established literature about design systems as opposed to ever changing blogosphere and content changing websites.

### 3.1 Design Culture and History of Design Systems

“Design has been practised for ages: monuments, bridges, automobiles, subway systems are all end-products of design processes.” As Gibbons (2016) continues mentioning in the article, how design has been put behind in the business decisions and how companies have faced failures in their projects not providing the real needs of their customers. And as can be seen from industrial environment that consequently there is a shift in the design consideration, from afterthought to priority, because of the failure corporations have faced in meeting customers’ needs. Becoming popular with the terms like Design thinking, User Experience Design, Service Design, HCI design, *UX and design culture is beginning to dominate in corporate environment* (Colin M et al., 2015).

McConnell (2019) gives examples of the big giants (eg. Polaris by Shopify, Material Design by Google, Solar by Bulb) in the software world, about how they created guidelines in their system and embedded the system in their development culture. Group of practitioners around the globe are talking about design, design systems and various challenges companies have had been facing in their development environment due to lack of design thinking approach in their mindsets. They have emphasised how development of their own design system solved their consistency issues, increased speed in their work, improved their customer experience and improved their branding (Araújo, 2018). The development of design system is not happening only in present because of these challenges. Rune Madsen’s said in his keynote speech at UX Camp Copenhagen in May, 2017 (Madsen, 2017), design system concept is not new and thousands of them have been developed over years, NASA’s Graphics Standards Manual to Google’s Material Design. In fact, design systems carry even deeper history.

As said by Vesselov and Davis (2019), humans have been organising and categorising around the world from beginning of the time. The Bauhaus and Swiss design example from 1920s and 1950s, reflects the foundation of design system from that time. Simplicity and functionality as priority, typography, "form follows function" principles have been in use since those times.

Swiss designers from the 1970's really explored these ideas, like Karl Gerstner who wrote the book *Designing Programmes*. He did not talk about computer programs in his book but about the design system as a program (Gerstner et al., 1964). Then introduction of CSS over internet in 1994 and from table-based design to table-less design, then introduction of JavaScript and fast pace changing technology, brought more needs on creation of design system. In software development, use of component libraries, pattern libraries, reuse of code and such concepts came into use from earlier times. But with more technology advancement, more aware customer and struggle towards improving customer experience created chaos, which also brought need to introduce design systems in these industries.

Having understood the importance of design and design system, there is a need to understand what design system is. Following sections emphasise on understanding what is a design system and what it consist of as a system.

## 3.2 Defining Design System

Schneider et al. (2011) mentions in his book, about how the fields which have a settled definition are dying out of innovation and how unsettled definition of design has given it a strength to grow. So is the case with Design Systems. Every designer, blog, design community, company have their own definition of design system. It is becoming a very popular term. Although, the term existed in 60's but the interpretation and usage has transformed dramatically and drastically (Ackoff, 1962). These days the term is used more in software applications' or web applications' design perspective.

Design System is a hype in the market as can be seen from the last few years discussion about the topic on various famous UX blogs and websites. The popularity of Design System and adoption of buying or creating one is in trend as can be found from practitioner's talks, blogs and websites. Here are some definitions collected from various resources:



As Fanguy (2019) says in his article *"A design system is a collection of reusable components, guided by clear standards, that can be assembled together to build any number of applications"*.

Definition found in Nielsen Norman Group stated by Pernice (2019), says today's design system consists of Style Guide(s), Pattern library and Component library.

Design Systems also known as 'pattern libraries' or 'component libraries' promote quality, consistent UX design across products; and expedite the work of designers, developers, and anyone else working on a website, application, or any digital design (Rohn, 2019).

As quoted by Curtis (2019) *"A design system is a framework of practices that bring designers and products together. It is a platform to identify, decide on, and document what to share, whether a visual style, design patterns, front-end UI components, and practices like accessibility, research, content strategy."*

As Curtis (2017a) mentions, design system is a growing field, it is important to posit what a system is and how it fits, otherwise, its value can get undermined due to incoherent understanding.

Formally, a system is a set of interconnected parts forming a unified whole. In the case of design systems, this definition actually alludes to not one but three interrelated systems, a kit of reusable and interconnected parts, a set of cohesive, interconnected products, and a community of collaborative and interconnected people.

The role of design with large organisations is expanding, spreading across product teams and influencing decision-making at higher and higher levels. This scale makes it increasingly challenging to align designers and product teams to deliver cohesive, consistent experiences across a customer journey.

As quoted by Vitruvius and Gwilt (1826) *"Consistency is found in that work whose whole and detail are suitable to the occasion. It arises from circumstance, custom, and nature."*

Looking at various definitions and how practitioner's have been talking around the concept of design system, next section builds up a summarised definition of design system and focus upon what a design system consists of.

### 3.3 Anatomy of Design System

To understand the usability and benefits of a design system, it was important in the research work to dig into the anatomy of the design system. As described above that there have been many definitions of design system by researchers, designers and organisations. Putting them together and extracting the common, a design system consists of the following parts:

- Style guide(s)
- Pattern library
- Component library
- Branding content like tone of voice and general guidelines
- Design principles and strategy
- Usability

Emphasis on the concept of modularity by Brad Frost in his book Atomic Design already speaks about this breakdown of Design System (Frost, 2016).

#### 3.3.1 Style Guide(s)

A style guide serves as a basis for development and is a collection of principles, guidelines and conventions brought together into a single medium to define a unified look and feel for products and services (Ohnemus, 1997).

Style Guides have existed in companies from decades, earlier in form of paper or catalogue and very less in digital form for software development (Gale, 1996). Style guides contains high-level details about color, typography, iconography (Vesselov and Davis, 2019). Style guide represented as a subclass of design system (Rutherford, 2017) or part of the design system (Frost, 2016) (Vesselov and Davis, 2019). They provide a static documentation of the visual language of the system. As Brad Frost mentions, style guides can provide different meaning and serve different purpose as per the requirements. They can define brand identity, writing, voice and tone, code, design language, and user interface patterns and thus he has categorised them

also on these basis (Frost, 2019). Though these guidelines serve different purposes, they overlap and influence other sectors and for large web applications or large brand corporate industries, combining these provide successful results (Frost, 2019). While the categorisation of style guide has come into design industry now, the reason of defining style guides can be traced from early software development (Gale, 1996).

For organisations which provide many applications as a single coherent system (Gale, 1996) or for organisations like Apple, Amazon, Google, where brand identity for different applications need to be consistent, user interfaces need to provide a consistent look. Not only the consistency in looks is demanded, but users expect consistency in usage also. Following these reasons, Apple, IBM, Microsoft have been known about their style guide definitions from 1990s (Gale, 1996).

However, it has been observed that style guides trying to solve these issues can also end up failing in solving these issues. It's very often that style guides turn into large documentation which becomes difficult to use and to update timely. It has been observed that many times either the developers don't know if there is established style guide or they are not eager to read and use one if exist. Also, as many a times, developers are not involved while creating the style guidelines, their problems don't get addressed. Also, how to use the style guide and the structure of style guide impacts on whether it will be a success for providing the right guidelines. Thus, check on usability of style guide is an important factor to be kept into account. Another factor to remember is the generic nature of the guidelines. If they are too generic to cover many applications, it can be a risk that it actually doesn't serve any. And, if it is too strict for one application, it can become hindrance on the creativity of designers and developers (Gale, 1996).

Thus, it can be summarised that in order to create a successful style guide to serve the purpose, it is important to keep it user-centric. The style guides should be developed in collaboration with developers, designers and end users of the product or application and following the iterative user-centred design process to keep the real users and process in.

### 3.3.2 Pattern Library

As Dürschmid (2016) says *Re-use is one of the core principles in professional software engineering*. Patterns, as the literal meaning says, provide

regularity and organisation in doing something. This is why in software development, pattern libraries are used by developers. This brings common understanding and prevents redundancy of design and code, especially when there are large number of teams or teams distributed globally. However, as Diana MacDonald (2019) says in her book, understanding of patterns and design systems as an industry has yet not recognised its place. It has been observed, that pattern libraries face similar problems like style guide development and maintenance. And similar like design systems, the definition of Pattern Library is provided by practitioners in their own way.

*"A pattern library is a collection of patterns, used to communicate and improve design decisions"* (MacDonald, 2019). Pattern libraries consists of UI elements like dropdown menu, accordion, etc. It is also observed that pattern library, style guide and component library are used interchangeably. In academic viewpoint, this interchange doesn't hold true. Many famous practitioners and authors have also emphasised on this ambiguity if terms interchange (Frost, 2016) (Curtis, 2017b) (Kholmatova, 2017).

As Frost (2019) also mentions about his findings on style guides in industry in different context and has provided a list where patterns and code are included.

Due to this ambiguity and interchangeable term usage, in this thesis differentiation between pattern library and component library is considered on contextual basis of a company. If a company differentiates between abstract layout and code separately, then they can be treated separate and if a company wants, it can combine them in their context. The emphasis is not on differentiation and definition but more on understanding the concept. Placing pattern library as a subclass in design system, where patterns define how a component should work, what should be the flow or behaviour and what could be the variations (Curtis, 2017b), and the company should provide it's definition and boundaries to separate it from other assets of its design system. Thus, the main goal should be to provide guidelines about user interface consistency and re-usability using an up-to-date pattern library which can support a base for component library for designers and developers as per their needs.

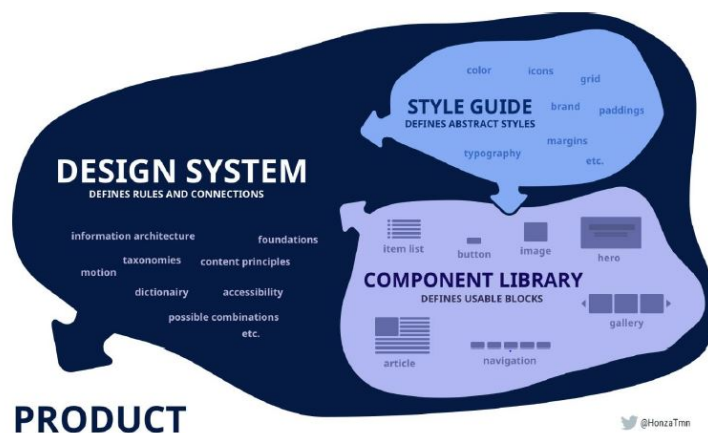


Figure 3.1: Design system connections (Toman, 2017)

### 3.3.3 Component Library

The word component library can be easily understood by the game of Lego's. Here component library is a collection of the building blocks of the whole building. Design system is primarily used by designers and developers. For developers the main task is to create the required features into the running system. But how the new feature would look like is the job of the UX designer which he/she gets after getting the requirement from the end user. A component library is a combination of style guidelines and UI components that the developers can further use into the given application but keeping the design uniformity intact (UXBootCamp, 2017) (Toman, 2017).

Component library can be a centralised repository of reusable building blocks which can be further used by the developers to build new features but keeping the design and style guidelines intact and consistent across the application (Jeng and Cheng, 1993).

Component library, though, brings in a challenge. To bring reusable building blocks integrated with code becomes programming language and platform specific. This can be challenging to a company when they are trying to overcome problems of inconsistencies by building their own design system, specifically for large companies with various products created using different technologies. This is one of the major challenge upon which the case study work is designed around to research on.

### 3.3.4 Branding Content

As every individual is unique so should be applicable for every brand. Companies these days are becoming global and selling customers a wide range of products, but they should have a unique brand. Not only range but there are various touchpoints of the company with its end users how to maintain a brand image which is consistent across the touchpoints can be challenging. This is where UX designers and design system come into picture. When a user uses a product, he/she is rather experiencing the brand behind it and UX needs to be aligned with that to create a design system which would depict the brand in each time a user interacts with the product.

As McConnell (2019) quotes *"A design system is an established way to collate replicable elements, patterns, tools and guidelines, to make sure anyone designing for a brand does so consistently."*

But these are more and more being used for the look and feel of the application rather than putting the core and content of the brand in it. The main purpose of design system should be to maintain the core of the brand not just the visual effects. Looking at a conglomerate like Amazon and its journey from a books retail brand to online shopping to media content hosting platform. One thing that it has kept intact is the brand called Amazon. Amazon did shift gears but didn't drift across its journey and still managed to keep its brand. Polaris by Shopify is a great example where design system guidelines are most comprehensive and take care of each and every detail when creating a new component.

"The primary goal of branding is to establish a name that is recognisable, symbol, design and appearance that represents the company's unique brand identity and their product or service" (Leppanen, 2018). Social media, mobile apps, digital advertising and email newsletters are all examples of digital methods that help the brands to strive for more a wholesome brand experience (Tan, 2016). A sustainable digital brand management strategy is mainly focused on social media, web content and mobile apps to leverage the brand awareness, interact with customers and to guide the market reach (Templafy, 2018). As per Wheeler (2012) "Branding is a disciplined process used to build awareness and extend customer loyalty."

### 3.3.5 Design Principles and Strategy

Design principles can be called as the basic guidelines or rules to be used by the designers when designing any application, mobile app or any other piece of software which would be used by the end user. End user here can be a direct customer, a CSR or another system.

Design principles are widely applicable laws, guidelines, biases and design considerations which designers apply with discretion (Interaction-Design, 2019). Additionally, design principles are fundamental pieces of advice to make easy-to-use, pleasurable designs by applying them when selecting, creating and organising elements and features.

Raid (2019) presented 7 types of design principles.

- *Emphasis* – This basically means when designing something, it can be a website or a mobile app, the first thing to emphasis is the brand. One brand can have various line of business but it is the responsibility of the UX designer to make sure brand stands out, irrespective of the product.
- *Balance and Alignment* – Each font, colour and alignment used can create an impact, so alignment is another key principle of design. Design if symmetrical creates a balanced product for end users.
- *Contrast* – Contrast is something that makes a design stand out. It can make a regular design extraordinary, so it is another key design principal.
- *Repetition* – If you could limit repetition and re-work and create design with reusable components then it brings great value for the end user.
- *Proportion* – Proportion is difference of size of an element in comparison of other and the whole application. This enhances the look and feel of the application.
- *Movement* – One application/website can have multiple information to share. How user moves from first information to second to third and so on is the work of designer to design it in a way and give the user a flow of information not just throwing balls and leave it on user to catch which ever he/she wants.
- *White space* – This is the empty screen on the website which also plays an important part when explaining the whole screen.

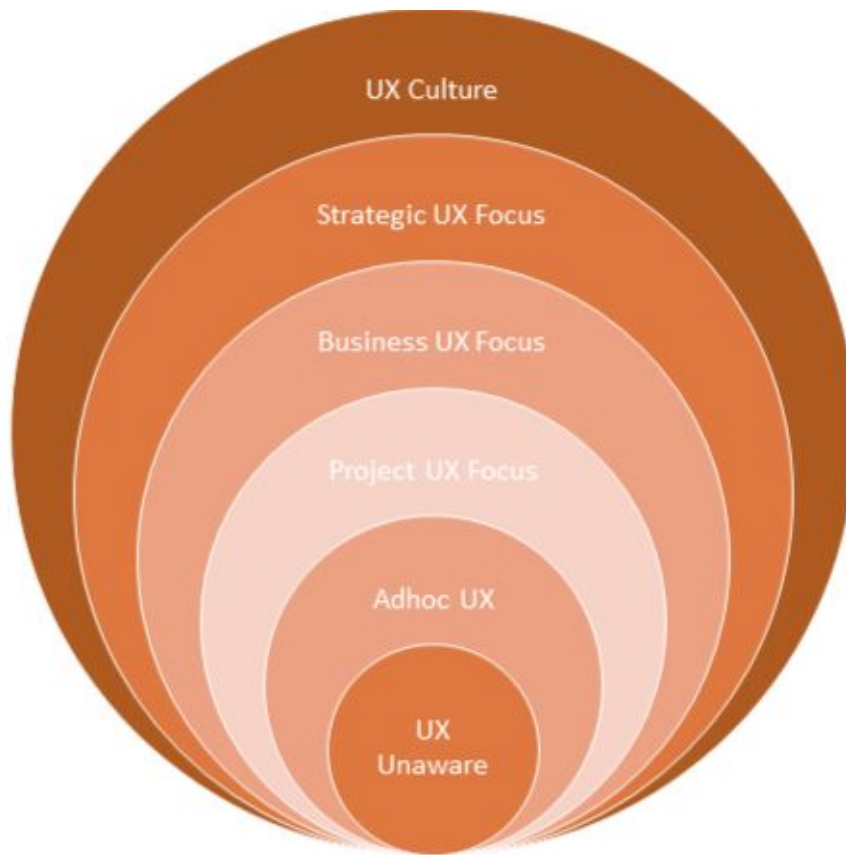


Figure 3.2: The strategic User Experience Maturity Model, Kreitzberg 2015

Along with these there are various industry specific UX design principles but those can be considered as the sub-set of these. More and more people are talking these days about UX and how it can help business and thus creating a strategy about UX. Kreitzberg (2015) says that there are two distinct concepts, UX Strategy and Strategic UX. UX strategy means the strategy the company wants to use to introduce or use UX into their current products and ways of working and business strategy. On the other hand Strategic UX would mean how the company would use design to define and drive its business strategy.

There have been various steps or models introduced to see how companies are evolving and accepting UX as their core value. This shows the phases from which companies go from UX Aware to a stage where UX becomes a part of culture of the company.



An organisation's ability to benefit from UX depends on how they survive this transformation from UX unaware to an organisation which has UX culture in its roots (Kreitzberg, 2015).

## 3.4 Benefits and Challenges of Design System

Design Systems of few top leading companies were studied to understand the rising culture in companies of building their own design system. Brightscout, a design and development company in Austin, surveyed the design system of the leading company in digital world and provided a list of benefits these companies have gained in their work.

The table in the figure 3.3 below provides a summary of the design systems of these companies along with their benefits (Jesswalrack, 2018).

When so many departments are involved in day to day production of content, it's really challenging to make sure that everyone conform to the same design patterns. A design system can provide a central set of guidelines that everyone can look at and apply (Madsen, 2017).

### 3.4.1 Benefits of using a Design System

From the survey by Brightscout (Jesswalrack, 2018), reading about design systems by companies like Google, Shopify, IBM, Atlassian, Salesforce, etc., and after reading literature of practitioner's, benefits of using design systems was collected which are listed below.

- Consistency across platforms.
- Free from waterfall processes of design team to development team practice. With design system it is like a continuous, interactive process of creating patterns and components.
- As it brings re-usability; designers get more time to work on new features rather than doing again and again for different pages and applications.

Figure 3.3: Features and Benefits of Design System of Leading companies

| Design System       | Company   | Features   | Benefits   |
|---------------------|-----------|--|--|
| ADG                 | Atlassian | <ul style="list-style-type: none"> <li>• Design patterns</li> <li>• Code components</li> <li>• Library of UI assets</li> <li>• Colorful and informative</li> <li>• Easy to understand</li> </ul>   | <ul style="list-style-type: none"> <li>• Increased efficiency</li> <li>• Work scaling across multiple products</li> <li>• Design consistency</li> <li>• Well-designed, well-defined documentation</li> </ul> |
| Material            | Google    | <ul style="list-style-type: none"> <li>• Visual language for users</li> <li>• Basic design principles</li> <li>• Tools and resources to create unified UI</li> </ul>   | <ul style="list-style-type: none"> <li>• Unify user experience across all devices and platforms</li> <li>• An open platform with tools and resources for developers and designers to create UIs</li> </ul>   |
| Polaris             | Shopify   | <ul style="list-style-type: none"> <li>• In-depth sections of colors.</li> <li>• Product is practical, presented well and provides logic that supports each choice.</li> <li>• Design system serves as a fixed point that orients how all work is done.</li> </ul> | <ul style="list-style-type: none"> <li>• Increase in consistency and efficiency in design.</li> <li>• Design blocks are more purposeful, consistent, reliable and clear.</li> </ul>                          |
| IBM Design Language | IBM       | <ul style="list-style-type: none"> <li>• Modernize and unify offerings</li> <li>• Flexibility for product teams</li> </ul>   | <ul style="list-style-type: none"> <li>• IBM engineers and designers work faster</li> <li>• Unified UI</li> <li>• Customized experiences for customers within line limits of branding</li> </ul>             |
| The Foundation      | Airbnb    | <ul style="list-style-type: none"> <li>• Company's style guide has loosely defined colors, icons and spacing.</li> <li>• Each defined component has a personality and function. They</li> </ul>  | <ul style="list-style-type: none"> <li>• With design system in place Airbnb can speed up development.</li> <li>• Engineers can focus on feature logic not code.</li> </ul>                                   |

- Consistent interaction patterns, standardisation of interfaces improves teams as well as customer's experience, brand awareness rises and so the product values increases.
- Re-usability of components also increase developer's efficiency and reduce code redundancy.
- Design system provide modularity, abstraction and high cohesion.
- Design systems increase collaboration and knowledge sharing.
- Design systems brings benefits to marketing teams also, they can promote about cohesiveness, time and code efficiency and maintenance of that project. Does boosting about their quick implementation of the new features.Madsen (2017)
- Design system provides good service and support as they bring well documented.
- Design system improve team communication.

### 3.4.2 Challenges of a design system

Though, design system provide so many benefits to the digital world to manage the work, there is a critique side too. The design system solve many problems but not that efficiently as needed. Also, the way design systems are implemented and used also brings challenges. Design systems constraints creativity. Following defined patterns and styling can bring monotonous shape to work and can affect designers and developers in being innovative and creative. Design process iterations for improvement gets stuck.

To bring order and to simplify the product design process, sometimes design system can result into terrible consequences where the benefits of the design system end up for only for designers and developers, not for the end user of the applications created by using that design system. Design system must bring consistency and coherence, but platform differences must be kept in mind. Mobile and web are not the same when it comes to user experience and so does the design system should be. Design system should be consistent, coherent but not a twin, rather consistent. Design system does not talk about processes and tools much. It should not only be about to bring in consistency but also about how to bring in consistency. Make design system an integral

part of the workflow. Over categorisation can be bad. Every project needs to make its own design based on the users of the product. Design system should be in the state to change easily over time to accommodate user requirement changes, technology changes and product uniqueness.

Design guidelines and usability guidelines or any type of guidelines missing the UX and UCD knowledge turns into read only document for developers while implementing the design or per say the requirement of the product (Henninger, 1997). The style guidelines are usually platform-specific or technology specific (Henninger, 1997). This imposes challenges on organisation to define unified guidelines to ease the implementation for developers and provide consistency across applications for their customers. The case study falls under similar situation with an additional challenge of providing a white label service and different development framework and environment.

### 3.5 Design vs. Development: Practices & Processes

Software development practices and processes is in general a process defining the software development work into phases. It does not have a strict definition, rather it depends from company to company on how they channelise their software development cycle.

On a high level we could divide software development process into five phases: Requirement Gathering, Designing, Development, Testing and Maintenance. There are various software development frameworks and their practices available like Agile, Scrum, traditional waterfall model, Kanban etc. to do software development. All have their pros and cons and it totally depends on the company which one to use during their software development process.

Few popular software development practices known are test-first programming (Test-Driven Development), rigorous and regular refactoring, continuous integration, simple design, pair programming, sharing the code base between all or most programmers, a single coding standard to which all programmers adhere, a common "war-room" style work area (CollabNet, 2019). Waterfall used to be one of the most widely used and traditional software development process but now companies are rapidly drifting or moving to new set of processes and practices stated above. Agile, Lean, Design thinking,

User Experience are the new methodologies and concepts that companies are accepting.

UX design is a relatively new and popular term these days. Since majority of companies are currently under a transition or doing a transformation to incorporate UX strategy in their current ways of working so there is no single list of UX design processes or practices. Though, Pines (2018) highlights some practices for UX design. Design should concentrate on user experience. User wants clarity and simplicity in applications. As there is so much content currently available, users get opportunity to switch easily if they feel complexity. Common design elements vs creativity is another factor to keep in mind. Gone is the time when every website used to be unique and should follow their design strategy. User these days don't have time to learn, explore or understand a new thing. e.g. login option is mostly at top right corner in most of the cases because that is where user expects it to be in most of the cases. UX designers are expected to be creative but the designs that they make can't be complex. Know your audience is another key aspect of popularity. Visual Hierarchy is another important practice to bring in, not only about how thing should look but how they should be placed in an order that user looks at the one which needs to be handled first. Online travel booking websites are an example where this is important. User Experience qualities like usefulness, usability, desirability, find-ability, accessibility, credibility are very important. Websites are scanned not read, implying that when users go to a website, they take few seconds to scan them and if found interesting they read the actual content. UX plays a key role in this.

Thus, practices are important in both disciplines and if aligned can bring benefits in design and development process.

### 3.6 White Label Products and Services

The research work in this thesis has its why, what, how coming from the development of white labelled service concept. The case department where the author did the study develops a white labelled service. The biggest challenge came up from the company when they ask this case department to apply and follow their design system for their service development. This is where the whole research on design system, evaluation of design system on existing work and further research work came on the front stage. The company's design system is a developing system which is supporting company

branded products and services.

Before delving into the case further it is prudent to define what is meant by white label service. White Label products are any product that is manufactured by one company and sold by another company that puts its own brand and model number on the product (Techopedia, 2019).

White labelling occurs when the manufacturer of an item uses the branding requested by the purchaser, or marketer, instead of its own. The end product appears as though it has been produced by the purchaser. White label in form of services is also a very known form. For example, bank providing credit card services but not having in-house ownership (Investopedia, 2019).

The key principal of white labelled service is to create a generic solution. Customers these days are not looking for specialised content. They are looking for a generic content and which can be customised or re-branded and which is easy to use (Smith, 2019).

Salesforce is a classic example for this (Salesforce, 2019b). Salesforce is a generic CRM or opportunity life cycle management system which is used from across LOBs. Finances, telco, real estate, banking, service industry, Airlines etc. Salesforce is everywhere. It offers various plug-in and use white labelled services which can be configured and used. Its apps can even be configured within the organisation for individual departments and tailor made as per the requirement. Advertising and Social media are more examples which can benefit a lot with white labelled services. E.g. advertisements for Telco's, Airlines service providers can be quite similar so templates can be re-used.

## Chapter 4

# Research Process and Methods

The thesis work was carried out at the premises of R&D centre of a multinational networking and telecommunications company. The research work done in the thesis is empirical in nature. The research started with understanding the department, the researcher was given position in. As discussed earlier (in Section 1, Introduction), the company laid out the perspective of understanding and analysing the holistic approach to apply central design system to the case department (white-label service project) covered in thesis. The concepts covered in the research work includes terms which could have a lot written about them in their own rights. The scope of thesis and time have considered to limit the boundaries and not dive deep into the Pandora box. Thus, the process followed had careful planning about scope.

### 4.1 Research process

The thesis follows the empirical research process (Jenkins, 1999) (Sari, 2019):

- **Idea:** The idea part covers two aspects. The first was the need of the company to analyse applicability of the central design system to case department. Second part of idea came when the analysis of the first part brought in new light towards improving the current state of the project from practices and processes perspective. The motive was to find ways to benefit the case department as well as provide takeaways to central UX team.

- **Literature Review:** As described in chapter 3, thorough study of already existing knowledge was done to avoid state of reinventing the wheel, but providing further academic contribution in the field.
- **Research subject and questions:** Based on the needs of the industry, research questions were formed and thesis work was done around them (Chapter 2). Personal observation and opinions are kept away while forming the research questions.
- **Selecting research strategy and method:** The research strategy followed here was a mixed methods approach. It combines mainly qualitative research (Section 4.3), with touches of quantitative research (Section 4.3) perspective influenced by constructive / design science research approach (Section 4.2).
- **Research planning:** Research planning was iterative in nature. It involved user study, system study, data gathering, data analysis and creating the solution concept.
- **Gathering Data:** Data gathering was done with a mixed combination of methods. The methods were interviews, survey, observing (participant-observing), document/archival analysis (described below in detail in section 4.3). Data gathering was done in real environment and thus flexibility in combining different methods was used. The researcher was not only an outside observer but also participated in action.
- **Analysing data:** This research includes mainly qualitative data analysis. The tool ATLAS.ti and affinity diagram technique was used for analysing interview transcripts. Details of technique are discussed in Research Methods and Research Implementation section and data analysis is presented in **chapter 5**.
- **Reporting results:** Efforts were made by the researcher to report results based on facts, evidences from the collected data avoiding bias based on opinions. Results are discussed in **chapter 5 and 8**.

Further in this chapter the methodology used in this study is introduced and its application is detailed in stages.



## 4.2 Design Science Research Methodology

Design Science Research (DSR), also known as Constructive Research, is a methodological approach concerned with devising artifacts that serve human purposes (Dresch et al., 2015). The research work revolves around the concept of design system and improving the processes and practices of the case department. Still, the study in the thesis resembles quite closely to the framework Hevner have examined in his paper (Hevner et al., 2004). Figure 4.1 is the framework referred to for the study. The authors in the paper used it mainly to refer to Information Systems but this case falls under similar environment. Hevner also defines Design science as a research paradigm where understanding and knowledge of a problem, its context, and its solution is accumulated in the design and application of an artifact. Thus, using the knowledge and reference of the Hevner's framework and design science research methodology, the thesis work was carried on.

The objective of the case company is to develop an internal system which guides the development environment. The factors which affect this research has organisational relevance to be considered. And as this is a thesis research, academic literature is reviewed, and author's knowledge is taken as a base while creating the artifacts. As Hevner talks about evaluation of a new artifact in a given organisational context affords the opportunity to apply empirical and qualitative methods. The empirical study includes a qualitative analysis spread over two areas: company's User Experience team and needs of developers divided into nine teams in case department. The purpose of the case department is to improve the effectiveness and efficiency of the department's work and to solve problems faced by developers with current component library. Thus, in first fold of thesis, the applicability of the design system is analysed and in second fold new artifacts were created using the found knowledge as well as base knowledge.

The purpose of this research is also to bring perspective scientific contribution to the field of Design Systems.

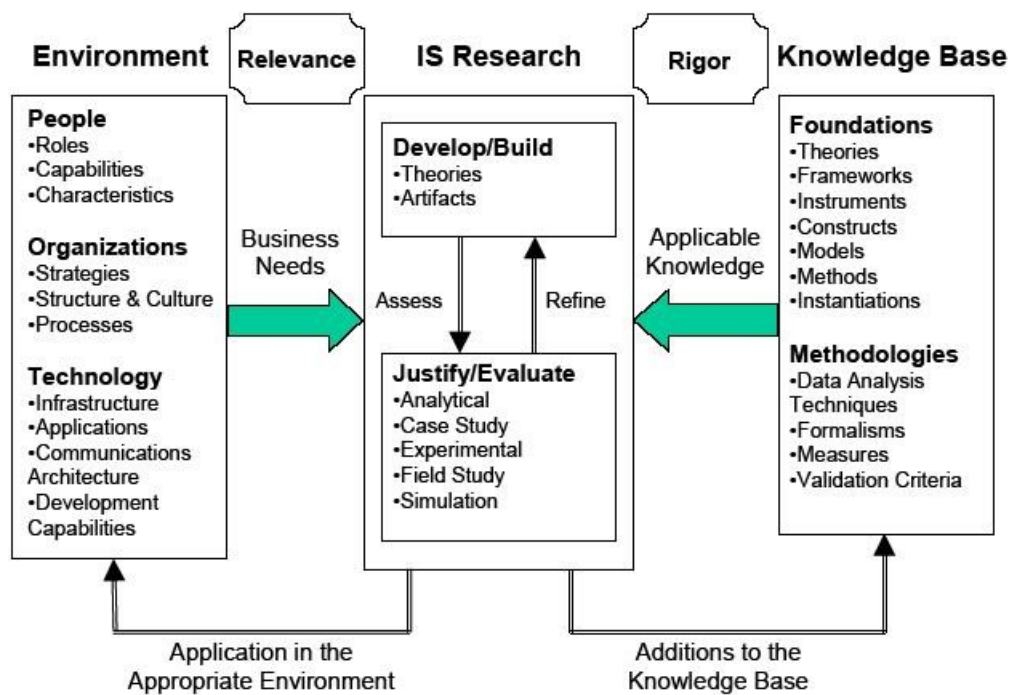


Figure 4.1: Information Systems Research Framework. (Hevner et al., 2004, Fig. 2, p.80).

## 4.3 Research Methods

This section describes important methods used in the thesis work, elaborating on why these methods are appropriate for this study.

### 4.3.1 Interviews

According to Badiu (2017), a quantitative study gives an idea only about how much and how many. To understand the why and to touch the human perception, it is important to take a qualitative approach as well. This is why mainly qualitative approach was followed in research work. And interviews are among very common methods of collecting data in qualitative research.

Interviews designed in the thesis work were semi-structured, with the idea of addressing dimension of the study as well as to provide flexibility to the interviewee to offer new meaning to the research study. Semi-structured interviews provide a space for the interviewer to explore the lived experiences as narrated in the interviews which may get unnoticed otherwise. Thus, providing more evidences for the contextual influences (Galletta and Jr, 2013). The interview questions are presented in Appendices A, B and C. Interview insights are discussed in section 5.3.1

### 4.3.2 Survey

While the researcher decided to take interviews during the thesis as method for collecting data, the lead designer suggested to conduct a survey. The reason for choosing to conduct a survey to get an overall understanding of large number of developers regarding UX and tasks related to UX team. The lead designer suggested to use the insights from survey also as the survey asked about expectations and it covered larger sample of developers than sample chosen for interviews. To get perspective from this way also, the researcher has used the results of the survey which was conducted with support of lead designer. Survey results are discussed in section 5.3.2.

### 4.3.3 Participatory Observation

To get first-hand experience of the tasks and to understand the people in the environment better, the researcher chose this technique (Ross, 2014). The researcher worked in the environment to get real-time experience of the UX library as a developer creating front-end assets for other developers. Also, researcher interacted with other developers and observed their work and tried to understand their domain too. The advantage of using this technique helps to learn in greater details about the environment to be able to perform tasks. As a participant, the researcher got a chance to understand group members better. This provided an opportunity to spend more time and observe them in varied situations to get more insights. This made others also more comfortable rather than being uncomfortable about getting observed all the time (Ross, 2014). This also provided researcher better opportunity to design and implement the solution meeting more needs.

### 4.3.4 Qualitative Analysis

Qualitative analysis primarily deals with texts, discussions, interviews or broadly to say what people quote. It is analysing the input that has been received from people and their experiences and come up with results from it. Qualitative analysis aims to increase the overall understanding of the quality, characteristics and meanings of the researched object or topic (Jyvaskylan-Yliopista, 2010). Qualitative studies can be directed by a conceptual framework, suggesting, in part, a deductive thrust, or driven more by the data itself, suggesting an inductive process. Generic or basic qualitative research refers to an approach in which researchers are simply interested in solving a problem, effecting a change, or identifying relevant themes rather than attempting to position their work in a particular epistemological or ontological paradigm. (Mihas, 2019)

Based on the data collected from interviews, data analysis was carried out. First, the interviews transcripts were written carefully. Following the methods of coding and affinity diagrams (Holtzblatt et al., 2005), findings were recorded and analysed for further work. ATLAS.ti is a qualitative research tool that can be used for coding and analysing transcripts and field notes, building literature reviews, creating network diagrams and data visualisations (NYU, 2019). Affinity diagram techniques was also touched upon to analyse survey results.

## 4.4 Research Implementation

The research work has two folds. To analyse the applicability of company's design system to the case department's project (white labelled service), researcher made an understanding of company's design system and studied the case department's project in detail. The second fold deals with the aim of making the current component library to support the developers enhancing their work experience. Thus, using Hevner's framework and design science research methodology, researcher implemented the work in stages as described below.

### 4.4.1 Stage 1: Understanding the problem

The first goal of the thesis was to understand the applicability of case company's design system to a service developed by one of the departments of the company. The service is a white-label service comprising many customers. The research work started by understanding the department's work. Further investigation was done on learning about the company's design system which represents central model of DS and UX. Then comparison and analysis of the case was done to evaluate the applicability. Researcher dived into academic and practitioner's literature to understand the concept of design system (Chapter 3) and learning how other companies are using it. This helped the researcher to understand and analyse the concept from various perspectives.

### 4.4.2 Stage 2: Group meetings and company's internal UX conference

In this stage the analysis and comparison of the centralised design system of the company and departments library of development was done. Group meetings were done between central team and department's team who is responsible for UX decisions and frontend of the service and internally between the case department. There was a huge impact on the decision making and results of the discussion after the meeting and UX conference of the company. The results have been discussed in Chapter 5, which led the researcher to move to Stage 3.

### 4.4.3 Stage 3: Interviews and Survey

Further work of thesis continued creating a prototype to cover the limitation of the results found in stages 1 and 2, of the thesis (comprising Stage 1 and 2). As the branding capability and development environment mismatch limits the applicability of design system, a prototype work was proposed and later implemented through actual work. To reach to prototype level, customer journey was created by understanding the customers who are developers and designers in this research. Considering the large number of teams involved in the study required an understanding of the overall scenario. Thus, this empirical study combined various methods. The researcher combined introspection, learning by doing as well as observation in the initial phase to study the environment. The study continued with survey and interviews to get a big picture as well as individual opinions for deeper understanding and wider context. The stakeholders involved in designing and developing a white labelled service comes with different skills background and knowledge. So, there are different mindsets and needs. Keeping these aspects into consideration, the participants selected for the interviews were developers and designers from different teams handling different requirements of the service development.

Initial questions were created by the researcher (presented in Appendices A,B,C) but flexibility in questions and use of extra questions was kept for deep understanding. The goal was to understand the point of view of the interviewee as motive of the interviews was to understand the developer's experience in using design system.

The teams were informed about the thesis work and reason for participation of the researcher from that perspective. Advance permission was taken from interviewees for recording the interview and quoting their words in the thesis in form of phrases. To keep company's and employees' privacy safe and secure, names have been kept anonymous in the results. Each participant is with label "User" followed by number (e.g. User1, User2 and so on). The work background of the interview participants is mentioned to provide better context.

The interviews were audio recorded and then documented as transcripts. Then the documents were read carefully and important words and phrases were picked. Based on the phrases, findings were recorded using affinity diagram technique as well as ATLAS.ti qualitative analysis tool.

Table 4.1: Interview Participants Description

| S. No. | Participant | Work Background      |
|--------|-------------|----------------------|
| 1      | User 1      | Full Stack Developer |
| 2      | User 2      | Back-end Developer   |
| 3      | User 3      | Back-end Developer   |
| 4      | User 4      | Full Stack Developer |
| 5      | User 5      | Design Lead          |
| 6      | User 6      | Designer             |

Survey questions are presented in Appendix D. Survey results are presented in Appendix E. Analysis of results is discussed in next chapter.

#### 4.4.4 Stage 4: Solution Design and Development

The needs were identified after analysing data. This led to redesign of the current application's frontend support in form of a microservice. The researcher created a prototype of it with the help of the design leader in the UX team. The discovery of the needs led the researcher to development of the conceptual UX Framework presented in Chapter 6. Implementation of prototype was done as part of researcher's work role. Implementation of the solution resulted in quite big scope of work which researcher will continue as part of work. Evaluation, iteration and further development of the conceptual UX framework is kept out of thesis scope because of the time limit considering the size of work and thus, is described as future work.

## Chapter 5

# Results and Analysis

The result of the thesis work is extracted from the ethnographic observation, interviews, participation in work and conducting survey. The hybrid combination of research methods provided insights from various perspective (CIRT and GCU, 2019). The methods have already been described in detail in Chapter 4. The results and analysis follow the same pattern as the stages discussed in Chapter 4 in Section 4.3.

To understand the results comprehensively, description about the company's central design system is provided in Section 5.1. Group meetings and their results are presented in 5.2.1. The findings about the applicability of central design system to white labelled service is presented in section 5.2.2. The qualitative data and insights gained from interviews and observation let to further assessment and development work in the research as explained in Section 5.3.1. The results of the survey are presented in 5.3.2. And finally, the results of the design and development phase are presented in section 5.4.

### 5.1 Stage 1: Company's Design System

The company carries a brand strategy from ages. There have always been efforts for providing good brand experience to their customers. The company's biggest effort came into effect after few years of work-time investment producing the new revision of brand which came along with the establishment of their design system released in December 2017. The company's design



system aims to provide guidance, assets and framework to their developers and designers to bring coherency and alignment in its brand.

There is a central team of 20-30 persons in their headquarters who is responsible for their brand strategy, UX design and strategy in coordination with their teams spread globally in respective units. The central UX team provides the company a platform which constitutes:

- continuous design and code release
- versioning of the design system to keep track
- change log and snapshots
- testing
- UX GPRs
- Data Visualisation

The content of their design system includes tone of voice, brand guidelines, design principles, etc. The design system also provides visual hierarchy, themes and colours, icons and layouts, design assets, etc. The system has repository with code snippets in various technologies, SDK, tutorials, components, patterns, assets, with very well-defined documentation and a team to support the designers and developers in globally established units of the company. The central team is responsible for brand content and User Experience design. The team makes progressive efforts to improve and advance the design system in various technologies and to meet requirements for the global projects of the company.

The first fold of the thesis research is about the case department and company's design system. Design system of this company supports development of the products which are either internal applications or applications offered to customers branded in name of the company. The twist in the research was to analyse the applicability of the design system to the service which is customer branded. Subsequent sections present findings on this matter.

## 5.2 Stage 2: Group Discussion

### 5.2.1 First Group Discussion

A group meeting with central UX team was requested by the author of the thesis. The author was accompanied in the meeting by case department's UX architect and design lead. Group discussion was held in Headquarters where company's Head team dealing with Branding, Design System and User experience experts is established. The thesis worker was allowed to take manual notes and analyse them to produce conclusion and findings.

The agenda of the meeting was to have a walkthrough of the current design system and understand the reasoning of the central team that why they want the department to apply the current design system. Another purpose of the meeting was to present the needs the case department has for their white-label service development.

Before the meeting was planned, the researcher already went through the design system from company's internal network. The researcher also studied the department's project by participating as an observer as well as doer. This pre study created a set of factors of comparison which were also discussed in the meeting. The factors are discussed in section 5.2.3 in detail along with findings around them.

The reason of the company to ask the department was to bring consistency of the white label service near to the rest of the offerings of the company. Also, the central team wanted the department to use guidelines on developing components from the design system and follow the processes and practices of the design system as much as possible. The recording of the meeting was not permissible but from the notes of the meeting the researcher can say that the central team did not analyse white-label service approach to a feasible level and this is why challenges and shortcomings were found in the design system as discussed in 5.2.3.

### 5.2.2 Second group discussion: with case department

On the basis of findings from central UX team of the company, another group meeting was requested by the author. This meeting was with selected mem-

bers from various teams of the case department in the company which was studied in the thesis. The members of the group included Design Lead, Portal Architect, System Architect, two back end developers and three full stack developers. The findings from the central team were discussed to analyse if the company's central design system is applicable for the case department producing white label service. The researcher presented the current state of the design system to the members of the meeting and asked question about effort estimation on development if they need to apply a new framework with new assets. In meeting discussion it came up that the components are available only for development environment using JavaScript and React. The moment the development framework changes, the component availability becomes challenging.

Furthermore, the department consists of its own component library developed on a Java based third-party framework used specifically for developing this service. The reason for choosing this technology and framework was figured out diving into the history of the product. This application was migrated from its earlier version to the current version. The programming language was Java and competency available in the company was mainly on Java. Considering the resource and cost efficiency, this technology and framework was chosen. Another important reason to consider is that, when this framework was chosen, company's design system was not available in this shape. The framework also provides an advantage, being an open-source framework for developing web applications, it also constitutes user interface components and tools to easily create and maintain user interfaces. Thus, different choice of framework brought the technology gap challenge to use the existing design system of the company. Also, initially, as the design system was also in very initial stage when the white-labelled project started, applicability was not considered in earlier stages. Later, it became difficult for the company to cover the gap not only from technology and framework perspective. Thus this discussion also brought in more insights.

The collective results of meetings and discussions are presented below.

### **5.2.3 Company's Design System vs. White Label Service Development**

Certain important factors were measured to find out the applicability and usability of central design system on case department's white labelled service

development. These factors came up when the UX lead and UX architect did knowledge sharing with researcher about some important points of their application. Researcher created these factors when studying company's design system and white-label service and was trying to find if these requirements of white-label services get fulfilled or not. These factors were used to make a comparison between company's design system and white-label service application which is presented below.

- **Development Framework:** The company's design system provides development frameworks which are different from white-label service. The white-label service is developed in Java-based framework. This creates a difference in components, patterns and styling assets. Thus, if the company wants the department to follow their framework then they need to create a new library of components, patterns, and all styling assets. The department need to start the development from scratch. Thus, framework dependency is the first shortcoming found in company's design system. The design system of the company and the project of the case department mismatch in terms of programming language and development platforms. Redesigning of the application developed in case department would require efforts at both ends.
- **Branding:** Company's branding content is for products and services which are offered in company's name. Whereas the case department offers multiple customers' branding content. Thus the central team has to define and develop design system guidelines and assets for white labelled services.
- **Multi-lingual support:** Current frameworks of the design system does not provide support for developing a service in multiple languages. But the framework used in case department provides this feature. Multi-lingual support is one of USPs of the case department's service. This mismatch will bring large amount of effort and risk for the white-label service to try new frameworks for the same features.
- **Effort for Transformation:** When the knowledge was shared with portal architects and developers and they were asked for the estimation of effort, then after their evaluation, it was found that huge amount of effort is required from both ends if the case department has to follow new guidelines and assets. They estimated time effort of approximately 2 years. Also, end users will be impacted as new requirements would be out to freeze during the transformation.

- **Business Impact:** The company will need to invest without any return of investment for developing new assets of the white-label service. The department either need to freeze new requirements or invest in bringing new resources for transformation. This would need in both case drop in terms of revenue. The new look and feel of the service due to new assets might also result in losing existing customers.

Thus, it was found that applicability of current state of design system is not feasible due to negative cost efficiency. Also, developers need to learn new skill-set to work as per company's design system platform which will affect their efficiency and the meeting sessions also reflected dissatisfaction to this approach, thus bringing in bad user experience of employees using the system.

Considering the analysis and as well as other organisation factors, the company decided to put a hold on the decision and let the department continue their own work.

### 5.3 Stage 3: Assessment and Further Work

As mentioned in the previous section, applicability of the design system proved not to be a cost and resource effective feasible solution for the case department of the company studied in thesis. Therefore, the current state of the department was studied in further detail. The current framework was used in practical work. The documentation about development of the library which was providing the styling and development guidelines was read. The assets for the application development were used. This study included development supported by interviews, user survey and participation research. The UX team (as they called it in the company), especially the UX architect and the Design Lead, handling the UX part of the service stated that development of the library for the service envisioned:

- bringing best possible usability of the service platform,
- unified look and feel and,
- helping developers in their daily work by providing reusable front-end components for their further development of the pages connecting the back-end

The researcher got involved in daily work to understand the work environment more effectively. As per the research process and planning (as described in Chapter 4), interviews were conducted.

### 5.3.1 Interview Insights

Based on the data collected from interviews, data analysis was carried out. First, the interviews transcripts were written carefully. Then transcript coding was done. Following the methods of coding and affinity diagrams, some evident answers led to identifying the challenges of the current system. Also, the interviews led to discovery of missing links and gaps in the processes and practices followed in the case department. The knowledge gap about UX and distance between design and development teams got reflected from the analysis of interviews. Quotations and analysis presented in this section provides base for the findings.

As seen in the review of literature, it has been mentioned that design is not prioritised or has been put behind business decisions. This is not only case with design in software industry but overall UX is also not yet a bottleneck as can be seen from the statements by the interviewees. The following quotations from interviewees provide the base for the findings:

*"Maturity of design is not very high so it takes some effort to get people to understand what you are trying to do" as said by the designer interviewee. "they understand the importance of a well-defined portal and user feedback but probably don't understand the importance of service journey." as said quoted by the designer interviewee.*

And developer also agrees on same - *"I think UX design is not considered important, mostly things should work, may be if alignment is not as expected. Design is important and we should use it more. Design is important, but coding is fun. Design needs more planning."*

It was also found that not only the importance of design and User Experience is low, the knowledge and understanding is also facing challenge. The right mindset and thinking about the topic is not found. As the back-end developer quoted in interview: *"I think UX is just a name and it is representing some new marketing stuff"*. Another back-end developer also speaks on similar track: *"I would say sometimes how things look or feel is not that important. I think if things work, it does not always have to be user friendly"*

*or smooth."*

Thorough analysis of these interview scripts was done using ATLAS.ti tool by creating code themes as presented in Figure 5.1. It shows the code groups which were formed where above mentioned quotations were categorised and grouped. Figure 5.2 show about the quotations which were related to how designers and developers visioned about the UX library which was a library having collection of components and styling used in the project with backend logic attached to them. Figure 5.3 shows about the quotations which were grouped in UX knowledge code analysing the state of knowledge people carry in case department related to UX, design and design system. These are few examples presented here. In this way, researcher took help of coding technique and reached to findings listed below which reflects issues the case department is facing while developing the white-label service.

- The vision of UX, terminology and language of UX team needs mapping to developers terminology and practices.
- There is communication gap between developers, UX team, Product Owners about defining their work.

As said by one of the developers related to this *"I think overall picture that we do is not clear enough for our POs and so it is not clear enough for UX lead also. It is because seems like customer doesn't know what he wants, and POs don't know what the plan is. I think much of it will be solved once we have more people interacting with the customer and then with the UX team."*

- Very less resources in UX team to support the development work  
*"Well currently we have few or only two UX people in the project and version 1 has been done already. If there are more people, we will use it more."* As the design and UX Lead also expressed *"I don't have many people here"*
- Lack of knowledge in company about UX, design as a discipline and design system as seen from above quotation
- Developers and designers not in contact with end customers during requirement phase
- UX struggled initially to reach to customers














|   | Name                          | Grounded   | Density |
|---|-------------------------------|--|---------|
| ○ | ◇ UX knowledge                |    | 8       |
| ○ | ◇ Importance of UX            |     | 3       |
| ○ | ◇ UX mindset opinion          |     | 3       |
| ○ | ◇ Communication Gap           |     | 3       |
| ○ | ◇ UX team responsibility      |     | 2       |
| ○ | ◇ UX library vision           |    | 10      |
| ○ | ◇ Expectations_Designer       |    | 1       |
| ○ | ◇ Designer-developer relation |   | 1       |
| ○ | ◇ Expectations_developer      |  | 8       |
| ○ | ◇ Engineering mindset         |   | 2       |
| ○ | ◇ Design System               |   | 3       |
| ○ | ◇ Shortcomings                |   | 1       |
| ○ | ◇ Expectation_developers      |   | 1       |
| ○ | ◇ Communication               |   | 1       |
| ○ | ◇ UX library improvment       |   | 1       |
| ○ | ◇ Expectations_developers     |   | 1       |

Figure 5.1: Code Groups



**10 quotations for UX library vision**

Search Quotations

| ID   | Name  |
|------|---|
| 2:6  | UX library should define the rules on how it should be done               |
| 2:11 | UX library should be the backbone of the whole system                     |
| 2:12 | UX library more powerful  |
| 2:19 | It should be more controlling   |
| 2:20 | UX libraries are important to collect and idea was every time we have...  |
| 3:6  | UX library with its own documentation                                     |
| 3:13 | the culture of creating documentation                                     |
| 3:14 | we need to include the technical side also                                |
| 3:17 | Off-course it brings value. If you had a clear UX library, then we kno... |
| 6:14 | Interviewer – What is your understanding, whether the components shou...  |

Figure 5.2: Top 10 Quotations UX Library Vision

**8 quotations for UX knowledge**

Search Quotations

| ID   | Name  |
|------|---|
| 2:13 | It's not just the looks, it is interactions and how user experiences t... |
| 2:14 | focussing on the UX components for which user research and usability...   |
| 3:5  | Can you elaborate what is design system                                   |
| 5:1  | Maturity of design is not very high, so it takes some effort to get pe... |
| 5:2  | their understanding about UX is limited.                                  |
| 5:3  | What does a design system mean to you? Participant – It is a complicat... |
| 7:7  | How is your understanding on term UX library? Participant – It is a us... |
| 7:8  | As a developer what do you think is UX team's responsibility in this p... |

Figure 5.3: Top Eight Quotations of UX Knowledge

- Knowledge sharing, communication, documentation are problems found very common
- UX team need to follow agile ways and tools like Jira to align with developers in their ways of working

The analysis brought these issues in picture. Researcher was not supposed to solve each issue but to bring an overall solution where any company facing such issues could follow some way to solve these. Thus, along with the work described in next stage, researcher in parallel worked on creating a conceptual framework, which is presented in chapter 6.

The analysis also made researcher realise that these finding need further work by selecting samples of people for more interviews. Researcher also needed to iterate in the work, but due to time limitation, initial solution is presented based on this data. Limitations of the work realised during analysis and further work are presented in Discussion in Chapter 7.

Though, researcher realised that selecting more people to form better samples for more interviews couldn't be done in this state, but to get overall picture, survey results were analysed, as presented next.

### 5.3.2 Survey Insights

The case department's UX team conducted a survey to understand expectations people in department have from UX team. The researcher used the survey results with consent of UX team to analyse the case from quantitative perspective. The survey included three questions. The first question provided multiple choice selection with free text writing also. The second and third questions had free writing textbox. The questions asked about understanding of the case department over UX teams responsibilities, expectations from UX team and support from UX team. 39 responses were collected from the survey which was sent to 350 recipients. The survey question and results are presented in Appendices D and E respectively.

The answer to first question reflects that as the umbrella of UX concept covers vast amounts of topics, so does the responsibilities of UX team in this company. And the people to handle such huge amount of work is very less compared to number of teams they are supporting. Researcher analysed the answers to survey question 2 by collecting answers and grouping them like

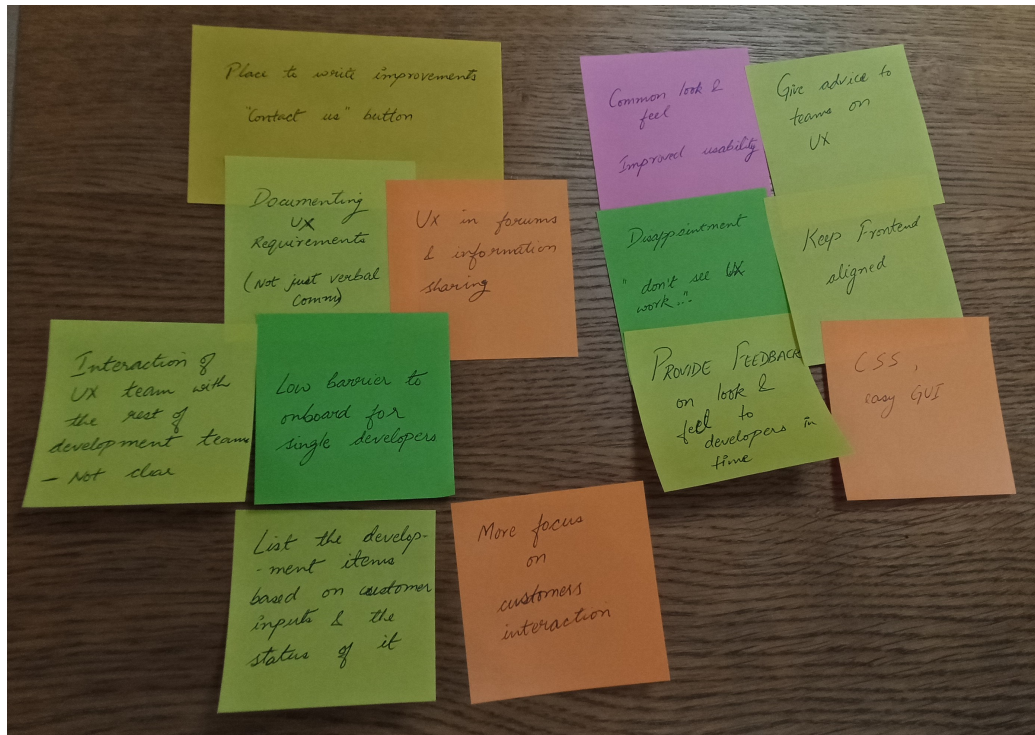


Figure 5.4: Survey Affinity Diagram

done in Affinity diagram. Although, exact implementation of affinity diagram was not possible as it was about one question only, the way was used to still get better insight. Figure 5.4 provides a glimpse of the notes made from the answers. The overall expectation of developers from UX team and UX library quite matches with the ones found in interviews. More focus on customers, more interaction with customers, more communication between developers, designers about their work, documentation, and expectations of developers from UX team related to UX matters, are the areas the answers were around. Developers are looking for more support, usability improvement of the application and for better look and feel of the application. The third answer reflects that out of the total people who have responded, approximately 74% feels that they get support from the UX team.

Based on these combined findings of interviews and survey, the work moved to next stage.

## 5.4 Stage 4: Solution Design and Development

After gaining knowledge from company's environment, systems and processes and from the analysis of data collected through interviews, researcher entered into implementation phase towards solving the issues found in the case department. Designing a design system was not the aim but improving the existing UX library was the main objective. The improvement was not needed only in the code of the library but also in the processes established around to understand, use, maintain and scale the overall system to improve the user experience of the system internally and the experience of the users of the application created by this case department of the company.

Researcher attended an internal conference in the company which happened during the thesis work. As a learning from the conference, practice of attending morning agile daily meetups of different teams was started. The idea behind was to understand ways of working of different development teams, to improve communication between UX and other teams and to assess what further work can be done to overcome the challenges found from interview insights.

The first step taken in the work was moving the UX library to its own project space. This was achieved with the help of Infrastructure team and portal architect. The reason for this movement was to separate the presentation layer from business logic. This improved in making the components reusable and reduced plenty of code redundancy already. A multi-disciplinary team was formed to develop this UX library layer as a microservice. Researcher did this work as an on-job trainee along with support of other developers.

According to designs provided by Design Lead, the UX library was transformed to have a different look and feel in this microservice. A roadmap was created and it was analysed by the researcher that complete implementation will go out of the thesis scope and time. Thus, it was sidelined from the thesis work but in company the process continued and researcher participated as much as possible. It was analysed and conveyed that this will be an iterative ongoing work, similar to maintaining a living system. After analysing academic and practitioners' literature, finding shortcoming regarding company's design system and case department white labelled service development, and identifying requirements from interview insights, researcher developed a conceptual framework which is described in Chapter 6.

### 5.4.1 Takeaways for Prototype Implementation

Having said that, it is worth to mention the benchmarking features found while studying the company's design system. The design system of the company has gone through phases like a software product and is following an iterative design thinking process towards its maturity roadmap. As (Curtis, 2016) says design system is like a living and evolving system (product) that serve other products. It was found that the company also takes their design system as a project when central team presented their updated design system in the internal UX conference. Measuring UX quality and maturity metrics are there in the process of the company. UX KPIs and UX GPRs are defined in the company. Thus, the evaluation of the design and development processes, design system and overall UX is measured in the company time to time. Importance, knowledge and communication around UX, usability and user research is encouraged.

The release version of design system reflects company's strong efforts in its UX strategy. The main design system is well defined, documented, maintained and improved. Company has established processes and practices. Improvement in tools, data visualisation, accessibility, technology updates, design and code contributions, demonstration and emphasis on effective communication are a few of the factors which appraise the company's successful journey covered so far.

Now, considering the white labelled service development system, it is important to bring out the effective points of that system. The case department has user research and usability tests available as context library for reference. The UX library used in the case department provide design guidelines, visual language, prototype templates, component library code and styling, etc. following component-based development supported with User Experience thinking mindset. The system is created where multiple customer branding is handled. Defining and establishing processes and practices has been a struggle in this department but continuous efforts are improving the system. The UX library of the department is also like in "Work in Progress" state.

The most important takeaway of bringing these main features of the two systems is to reflect how they can complement each other to overcome the gaps found in the study. The case department can consider the design system as benchmark whenever improvements or new requirements are there. This should be followed in general with all product and services developed by

the company globally. This will not only solve the inconsistencies in user interfaces but will also help in defining design and development standards for both the company offered as well as white labelled products provided by the company. Thus, the future focus can be on providing better user experience globally in all products and services. Similarly, the central design system can take the assets of the case department to include white labelled system assets in their main design system and improve upon them instead of creating from scratch. This way the central team will benefit all the teams distributed globally which are working on white labelled products. This will reduce huge amount of resource, cost and time which is now getting invested as various departments are creating their systems from scratch as per the needs of existing or new projects.

The finding and analysis motivated the researcher in designing a conceptual framework to expand the component library, include existing design system and adding additional components of the company's processes and practices which were scattered earlier. The framework is presented in detail in the next chapter.

## Chapter 6

# UX Framework

The UX framework presented in this thesis is the synthesis of what has been known, what has already existed or created but was not packaged well for the benefit. With the knowledge base of existing literature and additional empirical findings, researcher created this framework.

Based on the industry usage and findings of the research, the framework suggests the following assets in a design system:

- Style Guide
- Pattern Library
- Branding Content
- Design Principles
- Interaction Style Guide
- Component Factory
- Data Visualisation

These are supported with well established processes and practices. The system should integrate design and development in such a way that they follow the cycles of development and iterations of improvement in synchronisation. The practice of designing and then handing over for development and no improvements in design should be discouraged. A user-centred design

process should be defined according to the context. It must include design cycles, implementation, review and testing of prototypes followed by real time development. There should be collaborative guidelines on design and implementation developed in collaboration of developers, architects, designers and end-users. Gap between development and design teams has been a pain point from eternity. This framework proposes that collaboration between practices and process of design teams and development teams. Although from technical perspective these practices differ but customisation and search of common points can be immensely helpful. Collaboration in designing and development of components, reviewing them together from design and development perspective, combination of usability and software testing and quality framework testing the design as well as the code can also help in overcoming these pain points.

The white-label column is the extension of the company's design system which takes existing design system as reference repository. For white label services, the already created design system can be a benchmark. Thus, saving efforts of reinventing the wheel every time for new white-labelled customer or service.

Keeping in mind multi-platform and multi technology scenario, the concept of design tokens (salesforce, 2019a) should be adapted and customised as per the company's requirements. Figure 6.1 gives an overall picture of the framework. It presents an idea that how design system should get influenced by certain factors while it is developed, then used and maintained. The presence of these factors all the time can help overcoming the problems found during study, not only for the company but in general for any company as these problems are common. The problem of user interface inconsistency is the reason of birth of design system but this problem still exists. Thus, design system still needs to mature to solve this problem.

Figure 6.2 provides the next maturity level of design system which defines what assets it constitute, what practices and processes it should include and how it can also support development of white-label services.



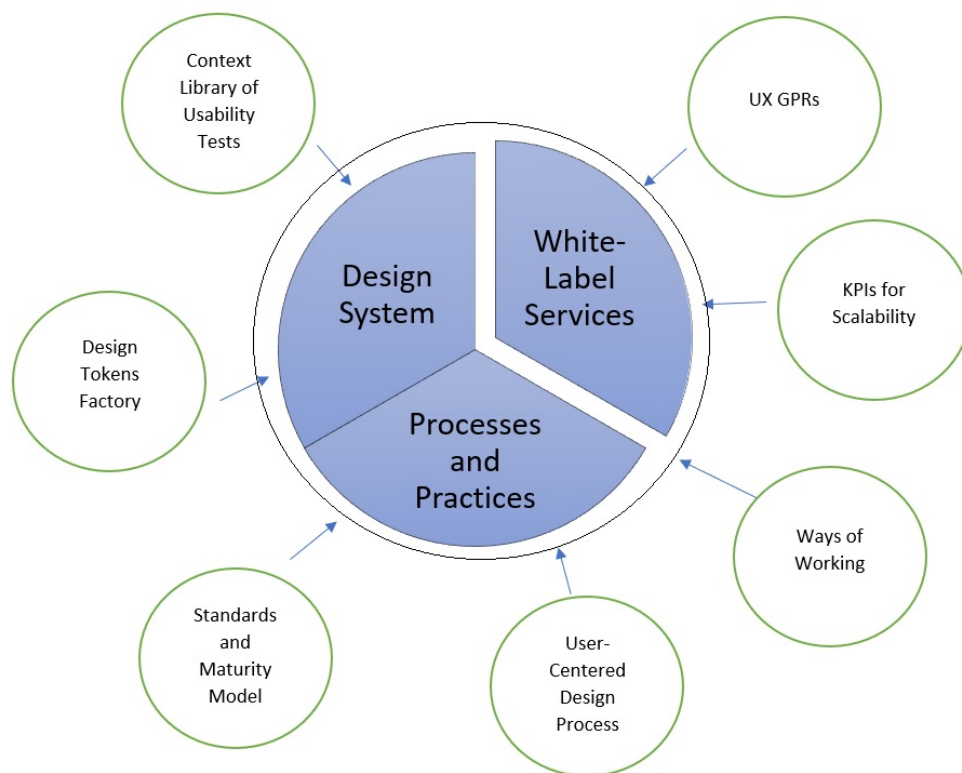


Figure 6.1: Conceptual UX Framework Complementing Design System

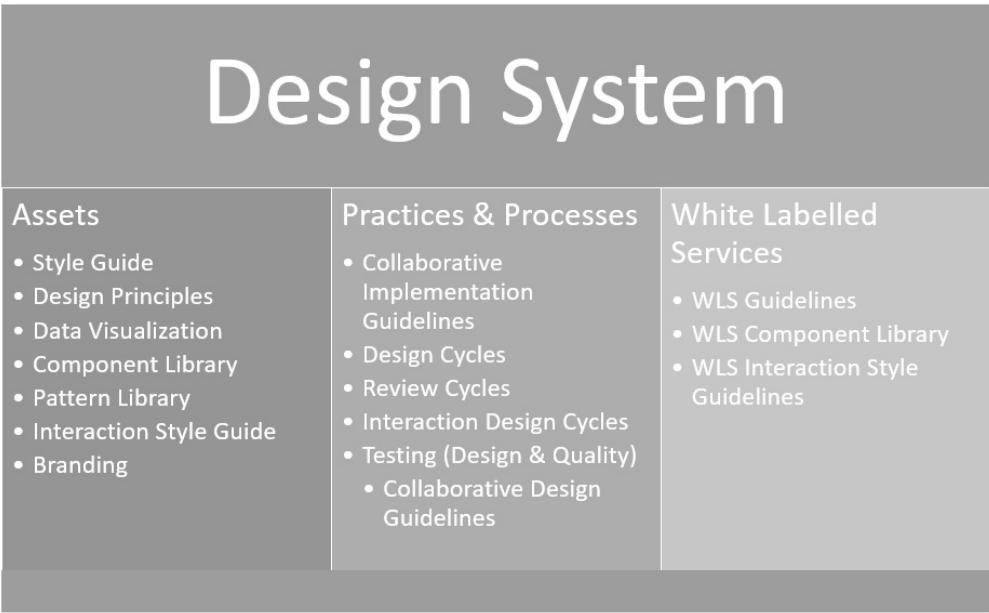


Figure 6.2: Proposed Design System

The additional supporting elements for development, maintenance and scalability of the design system are proposed. The supporting elements include UX GPRs, KPIs, standards and maturity model, Context Library of usability tests, and ways of working influenced and integrated by UX.

As found during research work, the case department’s UX team not only test the application modules but also do usability at component level. This gives an advantage to show the components to the customer at an initial level and changes could be implemented at an early phase of design. This also saves the effort that would have been spent in re-work (?). As observed, usability tests confirmed the validity, testing and quality at component level itself.

This UX model finally proposes the modifications the company’s need in defining their ways of working. The companies should keep in mind the organisation strategy as well as the design strategy when defining their organisational ways of working and departmental ways of working.

This is a basic conceptual UX framework in its first iteration phase. The challenge is to use this framework as a basis for software development in

different environments and evaluate its implications on design and development environments. Further development, testing, evaluation and further improvement can yield huge benefits for the industries. The scope of further work was out of time scope of the thesis. Thus, future work is recommended in the thesis supported with further research.

It is therefore imperative that design system is a package of different elements. With the broad and innovative thinking and collaboration of engineers and designers, design systems can scale to next level maturity under the light of UX and UCD.

The next section discusses about the research work of the thesis and the state of the art of design system in industrial world. The discussion opens a roadmap for further research work needed in the field.

## Chapter 7

# Discussion

Rise of design systems is an attempt to make order out of chaos (Vesselov and Davis, 2019). However, to deal with all the chaos, design system concept needs to mature and define standards to deal with the issues and challenges emerging in the software industries in terms of consistency, design thinking, UX establishment, fast pace ever-changing technology. As Brad Frost has said in his book (Frost, 2016), following Agile and being agile is different. Similarly, adopting culture of having design system because of trend and creating one as per your own needs is different.

Going back to Hevner's (Hevner et al., 2004) model, the thesis work has covered various aspects of that model and touched different areas to various levels. The research work analysed the environment, assessing the state-of-the-art of design system through the literature review and knowledge base of researcher helped in selecting and executing the methodologies.

The research work reflects design system is a packaging of different elements of software world as per the needs of the industrial environment in the right time. Systems, processes and practices, standards and models have existed in software engineering world. HTML, CSS, and other technologies to support, testing strategies, frameworks and libraries have already existed. Design process and principles have been playing their role in development world. The beginning of design system concept focused on the design aspect and later with more evolution, it started scaling to different areas.

Design systems cover the missing gaps or loop holes which were missing towards creating products and applications which are user-centred, solve the

desirable problem, are usable passing the heuristic rules and sustainable. The different assets of the design system have existed in software world and design world (Madsen, 2017). The need of the time was to collaborate them together which brought the concept of design system in highlights.

This section will present the limitations of the study and the recommendations for the company to reach the desirable maturity of design system. The future contribution of this work will also be discussed in brief. The contribution of this study is two fold.

First, it evaluates how a company can develop its design system to deal with White-Label services. which demands different branding and styling but still requires consistency and fast pace balanced and fashioned development of ever growing requirements. The empirical work foundation and a set of guidelines and practices will eventually take the Design System to such level that it will facilitate work for customer branded products as well.

Second, this thesis proposes a conceptual UX Framework from which practitioners can advance in their organisation's work and future practices. This framework facilitates to bring design thinking mindset revolution to combine with agile and lean. These two concepts have provided disruptive innovation to the software development. Now is the time to combine with design. There are books, articles, talks and research work going around to combine agile, lean and design. Design system have yet not been defined in the academic world. No ISO standards or similar perspectives exist for Design System. There is a need for thoroughly researched and static reference. This thesis and similar works aim to provide such academic recognition and advancement to design system in future.

## 7.1 Limitations of the study

- The thesis covers concepts which creates a master's thesis research work, so the researcher needs to keep in mind to limit the scope of every concept. Branding, multi-branding, expansion of component library, establishment of web-based design tokens to remove technology and framework dependency are such examples.
- Considering the time limitation of the thesis work and two folds of the thesis, the second fold is a progressive work which can be justified from

job point of view rather than research point of view.

- The researcher while working on second fold of thesis found that the interview questions needed to be improved which can be taken as recommendation for the researcher in future work. The issues find in interviews need to iterate interviews by different sampling of people. The interviews should be done with more developers as one sample, designers as one sample, management as one sample and interviews from central team of the company. This will provide better insights and verification of solutions proposed in first iteration.
- Iterations with design and implementation of conceptual UX framework is the biggest limitation this thesis could not cover in. The framework need to be applied and tested in real environments. This framework can be inspired further by the four pillars concept presented by (Shneiderman et al., 2009), in context of successful user-interface development.

The four pillars can be studied in detail in context to design system and current industrial state and can provide improvement insights to develop the framework better.

## 7.2 Recommendations for the company

As found from the study that company has their design system as a project which they are improving and updating with time as per needs and requirements. This study provides an additional perspective. As seen from first fold, the company's design system is not mature enough to support white-label service development. Figure 7.2 gives a view about how the company can scale its design system to support more projects, especially white-label services.

When researcher entered in the participant phase of the research process they she realised that the central UX team and the department's UX team don't have continuous communication or feedback loop. Secondly the researcher found that the company's design system does not provide any assets to any of its departments to develop white label services. Although work is in progress for this step, but the company needs to be careful as the company's different departments are creating their own component libraries from scratch to develop their white label services. All in all, the researcher

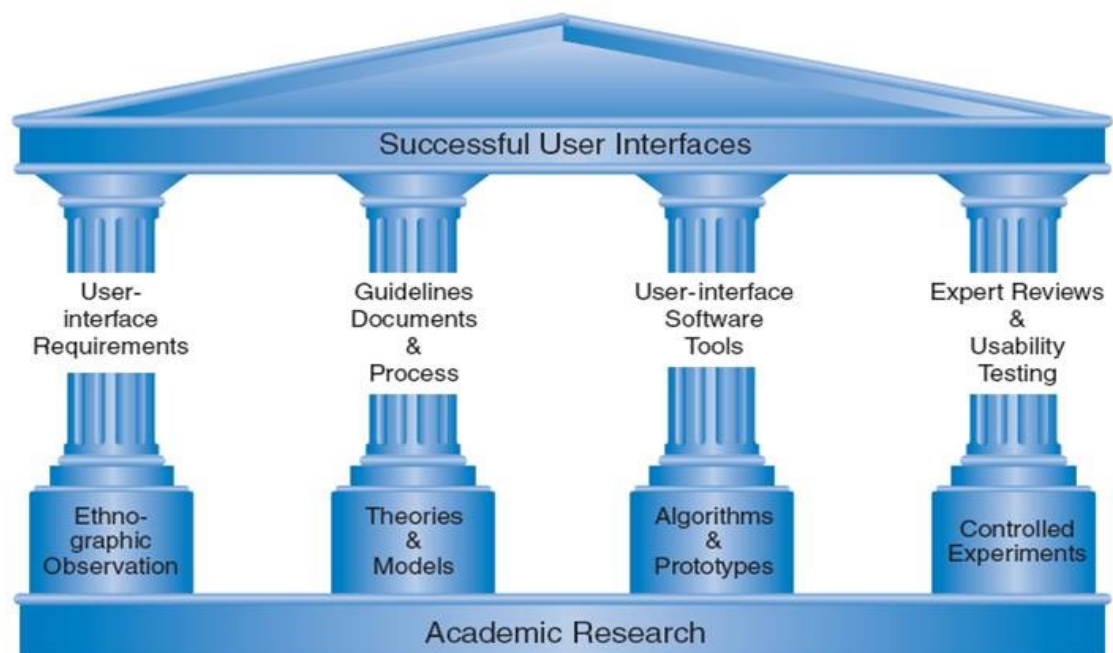


Figure 7.1: The Four pillars of successful user-interface development.  
(Shneiderman et al., 2009)

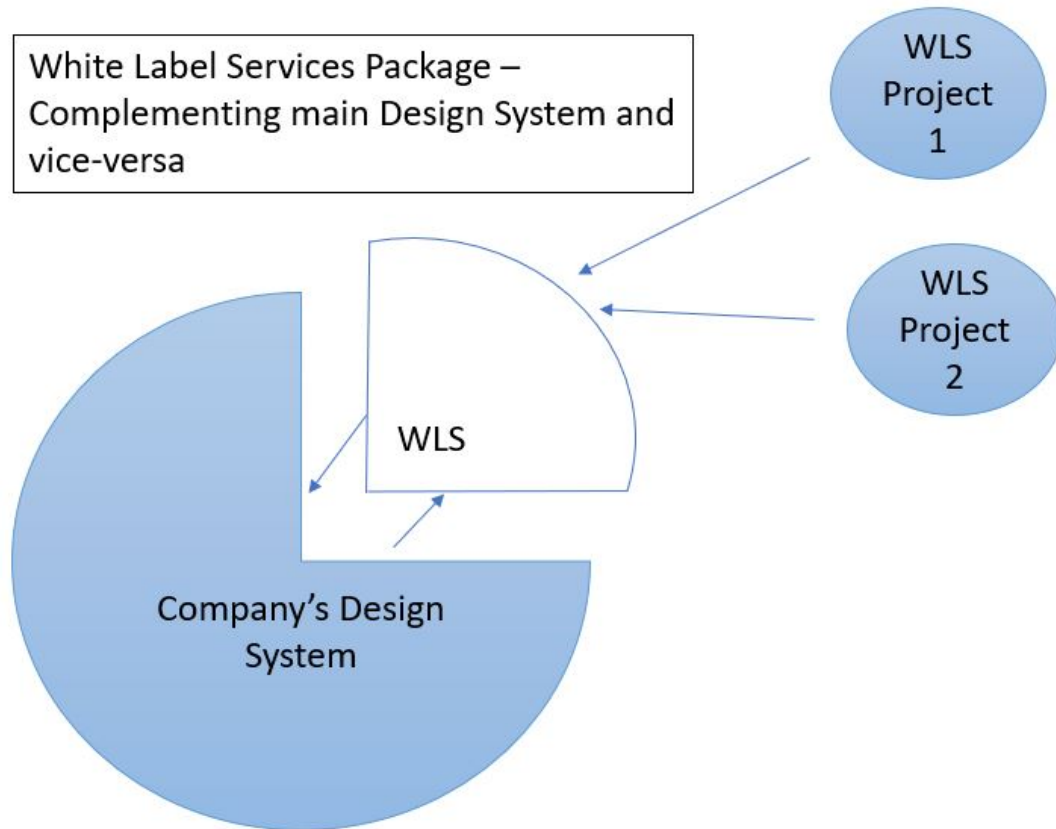


Figure 7.2: Proposal for maturity of Design System to support development of White Labelled Services

proposes to consider the conceptual framework provided in the study and let the researcher progress in her further implementation, evaluation and testing phase to make this framework more valid.

### 7.3 Future Work

The thesis contributed for defining processes and practices in design system mainly in development of white labelled services, then providing a generalisation scaling the usage of design systems. The thesis has provided a conceptual UX Framework. The framework needs to pass through the process



of iterations of user-centred design process. And then testing and validating its usability, usefulness and scalability with internal users, mainly designers and developers using it to create products and services. Further, measuring the success of integrated basic assets of design system with processes and practices and extending the white labelled service block, through the user experience of the end users in using the application created using this framework.

There is a huge scope of research on the concept of design systems to explore the potential. This study measured the potential using the case of white-labelled service. The findings defined the practices needed to bring better implementation and operational aspect of design system. Bringing standardisation and maturity models, can extend the application of design systems to more areas benefiting the users of design system and end users of the products created using those design systems by enjoying a fantastic user experience.

## Chapter 8

# Conclusion

In this section, implications of results and analysis of this research work is summarised in accordance with the research questions.

### **Research Question 1 How can the vendor's own design system support the development of white-label services?**

As can be seen from the literature review and research work in the company, practitioner's world or the company has not provided detailed attention towards providing a design system which can support white labelled service development. As said by ? design system is a living system/product, which serves other products. The research work reflects that it not only serves other products, but it serves people also. It is like a Human-Centred system dealing with interfaces, people, principles, strategies (Section 2.4). It provides collaboration, improves communication, guides design and development by providing documented guidelines, and acts a framework with libraries to ease the design and implementation of a product or service (Section 2.4).

The case department's UX library is a strong example of designing and developing a white labelled service. The decisions as learned from the history of the case department, reflects how design decisions were taken to serve multiple customers with less effort and consistent look and feel providing a fantastic user experience. The limitations found in the department was from the collaboration differences between design and development teams. As proposed in the conceptual UX Framework by the researcher, the collaboration between processes, practices and ways of working can bring tremendous positive change in the work.

**Research Question 1a: What does a design system consists of?**

Through the knowledge gained from existing literature and through practical research work around design system, it can be concluded that design system is a living project which is yet to go through maturity state. The state of the art of the design system consists of Style guide(s), Pattern Library, Component Library, Branding Content, Principles and Strategy and Usability. The design system need to continuously develop and update itself keeping UX and UCD principles around it. Design System should not be platform or technology dependent. It should consists of concepts like design tokens so that projects using different programming languages and framework still can keep the main design system as benchmark. To support development of white-label services, design system should consist guidelines, rules, principles and assets for white-label service development too. The overall structure of a design system should stand around the conceptual UX framework proposed in Chapter 6. With time, the UX framework should improve and mature with verification and evaluation around users, and so does the design system which the UX framework can complement to.

**Research Question 1b: What practices and processes are included in design systems?**

The basic design and development principles defined in software engineering world hold their place as it is in design system too. The implementation and adoption of those principles depends on type of projects they are used in. The main principles and processes are described in literature review (Chapter 3). The additional principles and processes of design system depends upon the project, design system is used for and organisation's own principles and strategies. As learned from the company's design system, there is a main team representing centralised model of development supported by people from different projects in company representing distributed model of design system development. Different projects' teams contribute to design system development as per their own requirement but central team follow a review process to decide and define what asset need to develop, and where to place it and whether the work contributed by team should be included as it is in main design system or should be customised. Similar process concept can be followed in general in design system, no matter what kind of company is using it. Also, as seen in white-label service development, the design system should include processes where such requirements could be handled through a central repository. The design system principles should try to combine designers and developers common principles and processes to

provide collaborative environment for these two disciplines. This will result in products and services with better usability and overall user experience, as learned from the case department study in the thesis work. The development of system which will create products and services should also be user-centric.

**Research Question 1c: What are the benefits of a design system for white-label services?**

As learned from thesis work, there is no need to reinvent the wheel of design system for developing white-label services. The existing design system can act as benchmark for white-label services and additional customisation can be added to design system in its white-label service asset (as proposed in UX framework). The benefits can be seen from the case department's study. The agreement with customers about branding the service should be kept in starting of any white-label service development as the case company did. The rules and guidelines should be agreed with customer and documentation and communication of this agreement should be made before design and development work starts. A well-defined component library developed around these rules and guidelines can support the development of a service branded in different names. The concept of re-usability, less code redundancy and consistent user interfaces can be easily achieved in white label service development also by using central assets defined in a design system. The overall work reflects that design system can ease the work of white-label service development in the same way as design system's are doing for company branded projects also. Few additional customisation added to design system for white-label service can reduce huge amount of efforts and provide best possible user experience not only for users of service but also for creators of the service using a design system supporting white-label service.

**Research Question 2: What is the experience of developers in using a Design System?**

As seen from the interview insights that opinion in interpreting the field of UX and understanding importance of design differs between designers and developers at significant level. At the same time, there is an effort from both the disciplines to empathise with other and synchronise in work. With this insight, it can be said that developers are making efforts to understand the concept of design system. Design systems have been mainly designed keeping designers in mind and front-end developers. The full support for development is still lacking, as can be seen from literature review and thesis work analysis. The design system is providing support for developers at some

level of design, patterns, styling and components. But there is a need to consider development practices, architectural understanding and technical aspects of development also to support developers better through design system, as proposed in UX Framework in Chapter 6. And, keeping in mind the end user, will not only help the end user get better product, but will help developers to create products and services solving the right problem.

Of course, a centralised system of assets help developers from re-usability, less redundancy, and consistent user interfaces. As suggested in UX framework, influence of UX, usability testing, UCD process and standards, a design system can bring in best practices of software engineering automatically in developer's work to support them and bring good user experience in their work.

### **2a:How does a design system support developers in their work?**

As a system the company's central UX team as well as department's UX team provide their people useful, usable, quality framework to ease their work in developing production services but many challenges were found by the researcher. They were related to communication between the central UX team and globally distributed development units, as well as lack of communication between those department's design and development teams. It is found that centralised UX team is improving their design system progressively, the design principles, UX strategy and guidelines of the central UX should be documented in such a way that they can be used as a reference and can be customisable to a certain extent. As learnt from the developers of the case department, more documentation and letting developers also to interact with the end customer to understand the requirements better is needed. There should be COP for UX team as well along with more demos and knowledge sharing sessions. There should be a trans-disciplinary team where developers, architects, UX personal and everyone should be closely working from project kick off till delivery. As this could be challenging for huge project having many teams, therefore, each team should have one representative to participate in this trans-disciplinary team, this representative can act as a communication bridge between design and development environment. The same applies to the UX team also.

Thus, keeping in mind these takeaways and developing a design system keeping UX Framework in mind, can support developers quite well in their work.

**Research Question 2b: How to collaborate between design and development practices?**

Design and development come from different school of thoughts but design and development work in collaboration to develop a product or service. So, the design and development teams should sit and brainstorm to find a match between processes and practices. Those matching processes and practices should be documented to be followed mutually. The conflicting practices and processes should be resolved and the design and development practices not impacting each and other can be followed in their own domain.

The conceptual UX Framework is the main theoretical contribution of this thesis. Design System can be considered as an environment which if supported with mindset oriented by User-Centred Design Process, can result in providing the software industry to bring amazing experience to its users. This UX Framework complements design system. Iterative development and implementation of this UX Framework to different contexts in future can make design system to scale to next generation maturity.

# References

- Ackoff, R. L. (1962), *Scientific method: optimizing applied research decisions*. [online]. [viewed 15 March 2019], New York, Wiley [1962].
- Araújo, J. (2018), *Design Systems: benefits, challenges & solutions*. [online]. [Viewed 05 April 2019].  
**URL:** <https://uxdesign.cc/design-systems-62f648c6dccf>
- Badiu, R. (2017), *Quantitative vs. Qualitative Usability Testing*. [online]. [Viewed 05 April 2019].  
**URL:** <https://www.nngroup.com/articles/quant-vs-qual/>
- CIRT and GCU (2019), *R Overview of Mixed Methods*. [online]. [Viewed 05 April 2019].  
**URL:** [https://cirt.gcu.edu/research/developmentresources/ready/mixed\\_methods/overview](https://cirt.gcu.edu/research/developmentresources/ready/mixed_methods/overview)
- Colin M, G., Austin, T. and Shad, G. (2015), ‘Flow of competence in ux design practice [online]. [viewed 10 august 2019]’.  
**URL:** <https://dl.acm.org/citation.cfm?doid=2702123.2702579>
- CollabNet (2019), *Agile Programming Best Practices* [online] [viewed 15 October 2019].  
**URL:** <https://resources.collab.net/agile-101/agile-programming-best-practices>
- Colville-Hyde, B. (2016), *Structured Content: An Introduction*. [online]. [Viewed 31 January 2019].  
**URL:** <https://medium.com/immediate-media-product-technology/structured-content-an-introduction-f4218877b1e7>
- Curtis, N. (2016), *A Design System isn't a Project. It's a Product, Serving Products*. [online]. [Viewed 05 August 2019].

- URL:** <https://medium.com/eightshapes-llc/a-design-system-isn-t-a-project-it-s-a-product-serving-products-74dcfffe935>
- Curtis, N. (2017a), *Defining Design Systems* [online]. [viewed 10 august 2019].  
**URL:** <https://medium.com/eightshapes-llc/defining-design-systems-6dd4b03e0ff6>
- Curtis, N. (2017b), *Patterns Components* [online]. [viewed 10 august 2019].  
**URL:** <https://medium.com/eightshapes-llc/patterns-components-2ce778cbe4e8>
- Curtis, N. (2019), *Scalable Design Systems* [online]. [viewed 10 august 2019].  
**URL:** <https://uxilive.co.il/2019/scalable-design-systems/>
- Dresch, A., Lacerda, D. P. and Antunes Jr, J. A. V. (2015), *Design Science Research*. [online]. [Viewed 20 November 2019], Springer International Publishing Switzerland 2015.
- Dürschmid, T. (2016), Design pattern builder: A concept for refinable reusable design pattern libraries. [online]. [viewed 02 october 2019], in ‘Companion Proceedings of the 2016 ACM SIGPLAN International Conference on Systems, Programming, Languages and Applications: Software for Humanity’, SPLASH Companion 2016, ACM, New York, NY, USA, pp. 45–46.  
**URL:** <http://doi.acm.org/10.1145/2984043.2998537>
- Fanguy, W. (2018), *3 lessons learned from the history of design systems*. [online] [Viewed 05 August 2019].  
**URL:** <https://www.invisionapp.com/inside-design/3-lessons-learned-history-design-systems>
- Fanguy, W. (2019), *A comprehensive guide to design systems*. [online]. [Viewed 05 August 2019].  
**URL:** <https://www.invisionapp.com/inside-design/guide-to-design-systems/>
- Frost, B. (2016), *Atomic Design*. [online]. [viewed 16 October 2019], Brad Frost Web.  
**URL:** <https://books.google.co.uk/books?id=1e92vgAACAAJ>
- Frost, B. (2019), *Style Guides* [online]. [Viewed 11 December 2019].  
**URL:** <https://bradfrost.com/blog/post/style-guides/2/>



- Gale, S. (1996), A collaborative approach to developing style guides. [online]. [viewed 2 september 2019], in ‘Proceedings of the SIGCHI Conference on Human Factors in Computing Systems’, CHI ’96, ACM, New York, NY, USA, pp. 362–367.  
**URL:** <http://doi.acm.org/10.1145/238386.238572>
- Galletta, A. and Jr, C. W. E. (2013), ‘Mastering the semi-structured interview and beyond: From research design to analysis and publication. [online]. [viewed 10 october 2019]’, pp. 1–245.
- Gerstner, K., Geisler, H. and Pabst, J. (1964), *Designing Programmes*. Translated by Lars Muller in 2007. [online]. [viewed 16 October 2019], 3rd edn, Lars Muller.  
**URL:** <https://dl.acm.org/citation.cfm?id=1564986>
- Gibbons, S. (2016), ‘Design thinking 101. [online]. [viewed 11 september 2019]’.  
**URL:** <https://www.nngroup.com/articles/design-thinking/>
- Google (2019), *Design Create intuitive and beautiful products with Material Design*. [online]. [viewed 26 December 2019].  
**URL:** <https://material.io/design/>
- Henninger, S. (1997), ‘An evolutionary approach to constructing effective software reuse repositories. [online]. [viewed 05 august 2019]’, *ACM Transactions on Software Engineering and Methodology (TOSEM)* **6**(2), 111–140.
- Hevner, A. R., March, S. T., Park, J. and Ram, S. (2004), ‘Design science in information systems research. [online]. [viewed 10 march 2019]’, *MIS Q.* **28**(1), 75–105.  
**URL:** <http://dl.acm.org/citation.cfm?id=2017212.2017217>
- Holtzblatt, K., Wendell, J. B. and Wood, S. (2005), *Rapid Contextual Design: A How-to Guide to Key Techniques for User-Centered Design (Interactive Technologies)* [online]. [viewed 16 October 2019], 1st edition edn, Morgan Kaufmann.  
**URL:** [https://www.amazon.co.uk/Rapid-Contextual-Design-How-User-Centered-ebook/dp/B006FEU2NU/ref=sr\\_11?keywords=Rapid+contextual+design&qid=1577473787&s=books&sr=1-1](https://www.amazon.co.uk/Rapid-Contextual-Design-How-User-Centered-ebook/dp/B006FEU2NU/ref=sr_11?keywords=Rapid+contextual+design&qid=1577473787&s=books&sr=1-1)
- IBM (2019), *Carbon Design System*. [online]. [viewed 26 December 2019].  
**URL:** <https://www.carbondesignsystem.com/>

Idean (2019), *Hack the design system*, Idean Publishing.

Interaction-Design (2019), *Design Principles*. [online]. [viewed 12 September 2019].

**URL:** <https://99designs.com/blog/tips/principles-of-design/>

Investopedia (2019), *White Label Product*. [online]. [Viewed 02 October 2019].

**URL:** <https://www.investopedia.com/terms/w/white-label-product.asp>

Jeng, J. J. and Cheng, B. H. C. (1993), *Using formal methods to construct a software component library*. [online] In: Sommerville I., Paul M. (eds) *Software Engineering — ESEC '93. ESEC 1993. Lecture Notes in Computer Science*, vol 717 [online] [viewed 16 October 2019], Springer, Berlin, Heidelberg.

**URL:** [https://link.springer.com/chapter/10.1007/3-540-57209-0\\_7](https://link.springer.com/chapter/10.1007/3-540-57209-0_7)

Jenkins, A. M. (1999), 'Research methodologies and mis research. [online]. [viewed 10 august 2019]'.

**URL:** <https://ifipwg82.org/sites/ifipwg82.org/files/Jenkins.pdf>

Jesswalrack (2018), *8 Top Design Systems in 2018*. [online]. [Viewed 05 August 2019].

**URL:** <https://www.brightscout.com/8-top-design-systems-2018/>

Jyvaskylan-Yliopista (2010), *Mapping Research Methods* [online]. [viewed 27 December 2019].

**URL:** <https://koppa.jyu.fi/avoimet/hum/menetelmapolkuja/en/methodmap/data-analysis/qualitative-analysis>

Kholmatova, A. (2017), *Design Systems*. [online]. [viewed 15 March 2019], Freiburg: Smashing Media AG.

Kreitzberg, C. (2015), 'Ux strategy and strategic ux. [online]. [viewed 2 september 2019]', p. 1.

**URL:** <https://static1.squarespace.com/static/5492005de4b07708508198e8/54d8430de4b00ffa20f4b9b3/1423459085978/+Strategy+and+Strategic+UX-a.pdf>

Leppanen, N. (2018), *Design system as a tool for digital brand design*. [online] [viewed 15 October 2019].

**URL:** <https://www.theseus.fi/handle/10024/150972>

- MacDonald, D. (2019), *Practical UI Patterns for Design Systems: Fast-Track Interaction Design for a Seamless User Experience*. [online]. [viewed 2 September 2019], 1st edn, Apress, Berkely, CA, USA.
- Madsen, R. (2017), *The User Experience Of Design Systems*. [online]. [viewed 10 august 2019].  
**URL:** <https://runemadsen.com/talks/uxcampcph/>
- McConnell, R. (2019), *Why your design system should include content* [online] [viewed 15 October 2019].  
**URL:** <https://clearleft.com/posts/why-your-design-system-should-include-content>
- Mihas, P. (2019), *Research and Assessment Methods* [online]. [viewed 27 December 2019].  
**URL:** <https://oxfordre.com/education/view/10.1093/9780190264093.001.0001/-9780190264093-e-1195>
- Muratovski, G. (2016), *Research For Designers A Guide to Methods and Practice*, International series of monographs on physics, Sage publications.
- NYU (2019), *Qualitative Data Analysis: ATLAS.ti* [online]. [viewed 26 December 2019].  
**URL:** <https://guides.nyu.edu/QDA/atlasti>
- Ohnemus, K. R. (1997), Web style guides: Who, what, where. [online]. [viewed 2 september 2019], in 'Proceedings of the 15th Annual International Conference on Computer Documentation', SIGDOC '97, ACM, New York, NY, USA, pp. 189–197.  
**URL:** <http://doi.acm.org/10.1145/263367.263392>
- Pernice, K. (2019), *Design Systems and Their Benefits*. [online]. [viewed 10 august 2019].  
**URL:** <https://www.nngroup.com/videos/design-systems/>
- Pines, B. (2018), *7 UX PRINCIPLES FOR CREATING A GREAT WEBSITE*. [online]. [viewed 10 august 2019].  
**URL:** <https://www.webdesignerdepot.com/2018/05/7-ux-principles-for-creating-a-great-website/>
- Raid, M. (2019), *The 7 principles of design*. [online]. [viewed 12 September 2019].  
**URL:** <https://99designs.com/blog/tips/principles-of-design/>

- Rohn, J. (2019), *Design Systems and Pattern Libraries* [online]. [viewed 10 august 2019].  
**URL:** <https://www.nngroup.com/courses/design-systems/>
- Ross, J. (2014), *Participatory Observation* [online]. [viewed 27 December 2019].  
**URL:** <https://www.uxmatters.com/mt/archives/2014/01/participatory-observation.php>
- Rutherford, Z. (2017), *Design Systems vs. Pattern Libraries vs. Style Guides – What’s the Difference?* [online]. [Viewed 11 December 2019].  
**URL:** <https://www.uxpin.com/studio/blog/design-systems-vs-pattern-libraries-vs-style-guides-whats-difference/>
- salesforce (2019a), *Styling with Design Tokens* [online]. [viewed 12 December 2019].  
**URL:** [https://developer.salesforce.com/docs/atlas.en-us.lightning.meta/lightning/tokens\\_intro.htm](https://developer.salesforce.com/docs/atlas.en-us.lightning.meta/lightning/tokens_intro.htm)
- Salesforce (2019b), *What is salesforce?* [online]. [viewed 26 December 2019].  
**URL:** <https://www.salesforce.com/eu/products/what-is-salesforce/?d=cta-body-promo-72>
- Sari, K. (2019), *Research Methods in Software and Service Engineering: Introduction* [online]. [Viewed 10 October 2019].
- Schleifer, A. (2016), *The Way We Build*. [online]. [viewed 26 December 2019].  
**URL:** <https://airbnb.design/the-way-we-build/>
- Schneider, J., Stickdorn, M. and coauthors (2011), *This is service design thinking*. [online]. [viewed 10 August 2019], BIS Publishers.
- Shneiderman, B., Plaisant, C., Cohen, M. and Jacobs, S. (2009), *Designing the User Interface: Strategies for Effective Human-Computer Interaction*, 5th edn, Addison-Wesley Publishing Company, USA.
- Smith, D. (2019), *9 White-Label Services Solutions to Skyrocket Your Revenue* [online]. [viewed 27 December 2019].  
**URL:** <https://www.vendasta.com/blog/white-label-solutions>
- Suarez, M., Anne, J., Sylor-Miller, K., Mounter, D. and Standfield, R. (2017), *Design Systems Handbook*. [online]. [viewed 15 March 2019], DesignBetter.Co by InVision.  
**URL:** <https://www.designbetter.co/design-systems-handbook>

Tan, D. (2016), *Digital Branding [Part 1]: The Benefits*. [online]. [viewed 15 September 2019].

**URL:** <https://openmindsresources.com/digital-branding-part-1-the-benefits/>

Techopedia (2019), *White Label* [online]. [Viewed 10 September 2019].

**URL:** <https://www.techopedia.com/definition/24401/white-label>

Templafy (2018), *What is digital brand management?* [online]. [viewed 15 September 2019].

**URL:** <https://www.templafy.com/blog/what-is-digital-brand-management/>

Toman, J. (2017), *Design systems, style guides, pattern libraries. What the hell is the difference?* [online]. [viewed 12 December 2019].

**URL:** <https://product-unicorn.com/design-systems-style-guides-all-those-libraries-what-the-hell-is-the-difference-4c2741193fdc>

UXBootCamp (2017), *Pattern library, Style guides, Design Systems. Do you need one?* [online] [viewed 15 October 2019].

**URL:** <https://blog.prototypr.io/pattern-library-style-guides-design-systems-do-you-need-one-b7857af0f255>

Verganti, R. (2004), ‘Design-driven innovation : changing the rules of competition by radically innovating what things mean [online]. pp.75-105 [viewed 15 august 2019]’, *MIS:quarterly* **28**(1), 75–105.

**URL:** <https://store.hbr.org/product/design-driven-innovation-changing-the-rules-of-competition-by-radically-innovating-what-things-mean/2482>

Vesselov, S. and Davis, T. (2019), *Building Design Systems:Unify User Experiences through a Shared Design Language*. [online]. [Viewed 10 September 2019].

**URL:** <https://learning.oreilly.com/library/view/building-design-systems/9781484245149/html/4689541E2Cchapter.xhtml>

Vitruvius, M. P. and Gwilt, J. (1826), *De Architectura*. Translated from the Latin by J. Gwilt. [online]. [viewed 16 October 2019], Priestley and Weale.

**URL:** [http://penelope.uchicago.edu/Thayer/E/Roman/Texts/Vitruvius/1\\*.html](http://penelope.uchicago.edu/Thayer/E/Roman/Texts/Vitruvius/1*.html)

Wheeler, A. (2012), *Designing Brand Identity: An Essential Guide for the Whole Branding Team*. 4th ed. [online]. [Viewed 10 September 2019], John Wiley and Sons.

## Appendix A

# Interview Design for designer

- Please share about your work profile.
- What are your responsibilities in the project you are working on currently?
- How has your experience been on establishing UX understanding in an engineering environment?
- The project you are working on involves a service development which is customer branded. This doesn't involve company's DS. Could you explain how you manage brand and style requirements in the web application you are designing and developing?
- How has company's DS helped you in the current project you are working on?
- Do you communicate with customers on their requirements issues?
- Are developers involved in your work cycle when you understand requirements and design the prototypes?
- What's your vision on UX library?
- What kind of challenges you face in your work environment regarding being the only designer mindset in this huge development environment?
- What is your vision or goal you would like to achieve regarding design and UX in your company?
- Any other ideas and suggestions you would like to comment about?

## Appendix B

# Interview Design for developer

- Please share about your work profile in company
- What are your roles and responsibilities in your team currently?
- How was your on-boarding experience in this project? (to be asked only from the new developer)
- How is your experience with the project's pattern/component library/UX library?
- Have you contributed to the library? When and what? If not, why?
- How do you get updated about changes or new features in UX library?
- How is your experience with the UX library?
- How is your experience in communicating with the UX team?
- You communicate with the UX team?
- What problems you face with the UX library?
- How you get updated if other team has updated/contributed or developed a new component or pattern as part of the project?
- Do you attend the CoP meetings involving UX? Why or why not?
- Suggestions for overcoming the problems you have faced or are facing regarding UX library and communication with UX team?

## Appendix C

# Interview Design for software architect

- Please share about your work profile
- What are your responsibilities in the project you are working on currently?
- How do you feel about designer-developer relationship that you have currently in your project?
- What are the main challenge that you have faced if you have ever interacted with the UX team? Did you find any challenges in explaining them about the terminology?
- Can you elaborate what is design system?
- Have you ever contributed in creating UX library and have you ever used it?
- Does UX library influence your work?
- What improvement do you think is needed in UX library?
- How does CoP helps in your work? What CoPs do you attend?
- Do you attend CoPs involving UX team?
- Any other ideas and suggestions regarding the challenges you face in your work?



## Appendix D

### Survey Questions

### 1. What do you **think** UX team is doing?

The purpose of the list is to give you ideas :-> It is not exactly reflecting our daily work.

- |   |   |
|---|---|
| <input type="checkbox"/> Planning and conducting usability tests      | <input type="checkbox"/> Working on navigation and site structure |
| <input type="checkbox"/> Doing GUI design                             | <input type="checkbox"/> Creating future UX concept design        |
| <input type="checkbox"/> Gathering and organizing statistics          | <input type="checkbox"/> Doing copywriting                        |
| <input type="checkbox"/> Collaborating with customers                 | <input type="checkbox"/> Arranging stakeholder workshops          |
| <input type="checkbox"/> Making prototypes                            | <input type="checkbox"/> Creating terminology                     |
| <input type="checkbox"/> Doing end-user research                      | <input type="checkbox"/> Doing demo webinars to customers         |
| <input type="checkbox"/> Developing personas and scenarios            | <input type="checkbox"/> Doing release webinars to customers      |
| <input type="checkbox"/> Drawing service blueprints                   | <input type="checkbox"/> Interviewing users                       |
| <input type="checkbox"/> Doing project management                     | <input type="checkbox"/> Making customer presentations            |
| <input type="checkbox"/> Creating UX strategy                         | <input type="checkbox"/> Developing GUI component library         |
| <input type="checkbox"/> Writing UX requirements                      | <input type="checkbox"/> Creating user journeys and stories       |
| <input type="checkbox"/> Drawing mock-ups                             | <input type="checkbox"/> Checking translations                    |
| <input type="checkbox"/> Participating development teams' dailies     | <input type="checkbox"/> Making design sprints                    |
| <input type="checkbox"/> Planning UX activities                       | <input type="checkbox"/> Implementing GUI                         |
| <input type="checkbox"/> Designing visuals                            | <input type="checkbox"/> Doing front-end development              |
| <input type="checkbox"/> Participating service stream weekly meetings | <input type="checkbox"/> Coordinating design workshops            |
| <input type="checkbox"/> Making interaction design                    |   |

Something missing? Please add.

0 of 3 answered

Figure D.1: Survey Question 1

## 2. What are your **expectations** of UX team?

Please describe with your own words. We don't promise anything but we'll get the idea.



Figure D.2: Survey Question 2

## 3. Do you think you get **support** from UX team?

☐ Yes

☐ No

Please elaborate.

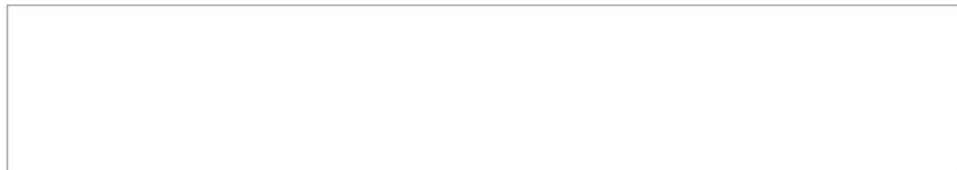


Figure D.3: Survey Question 3

## Appendix E

### Survey Result

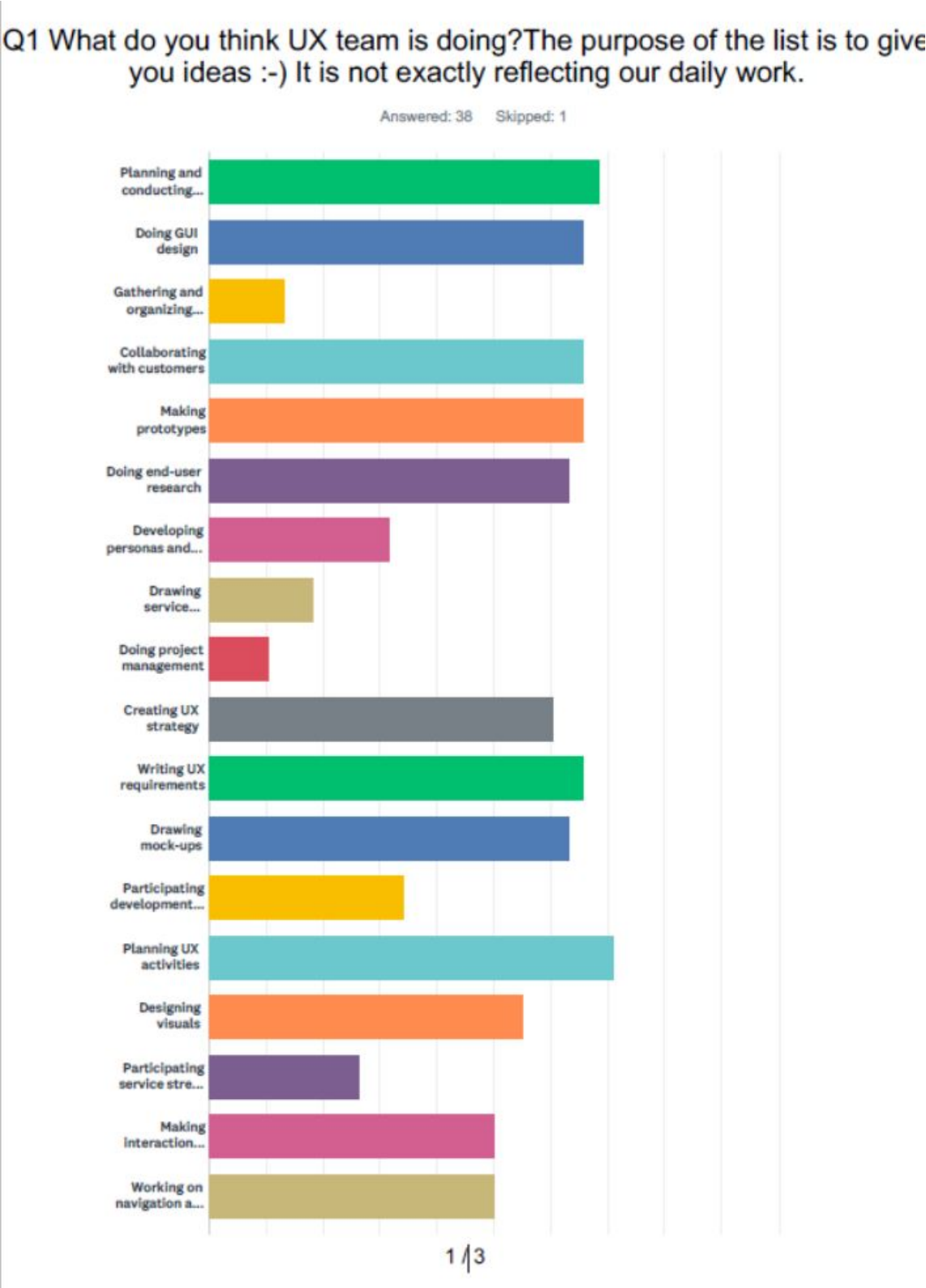


Figure E.1: Survey Answer 1

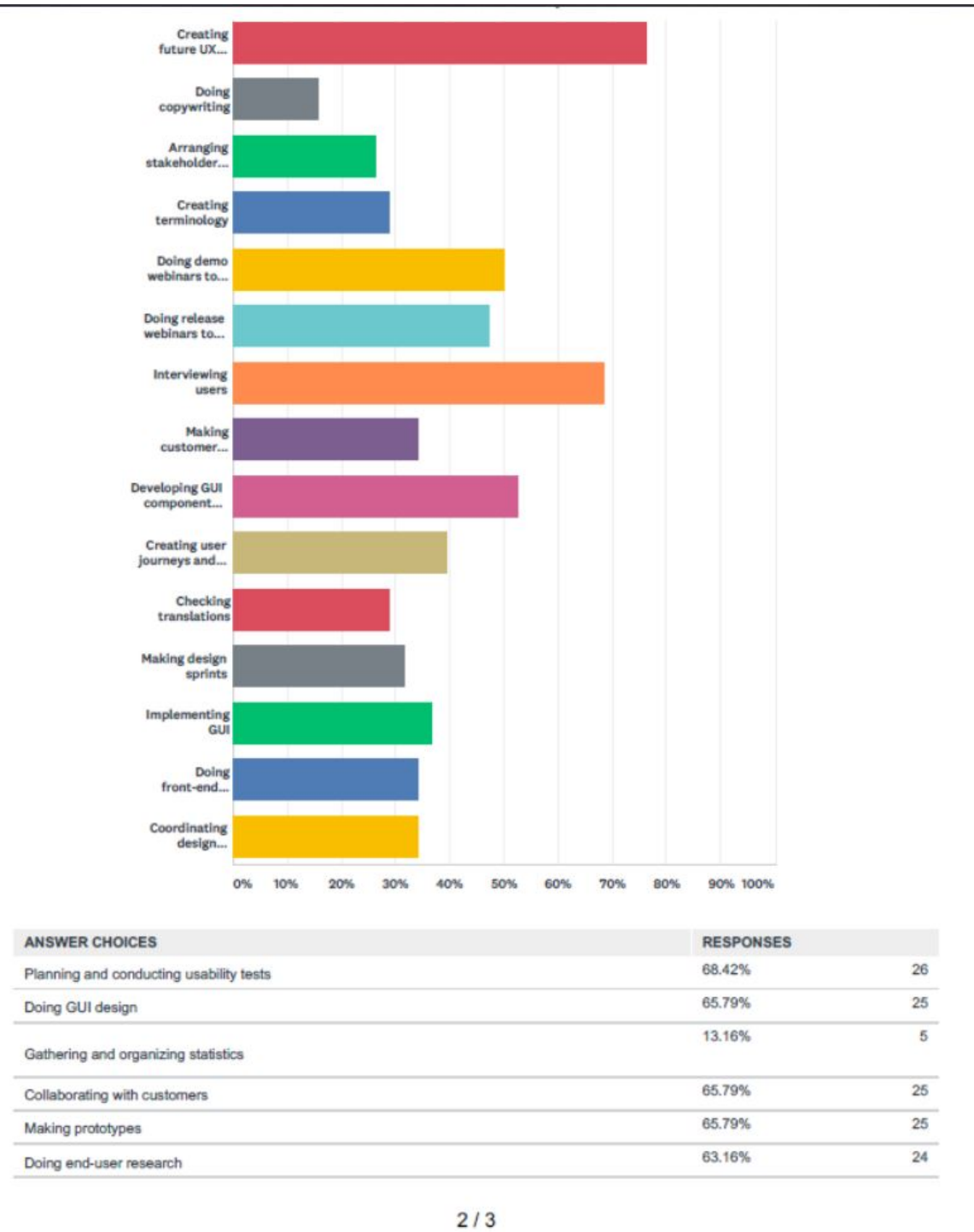


Figure E.2: Survey Answer 1

|  |        |    |
|--|--------|----|
| Developing personas and scenarios            | 31.58% | 12 |
| Drawing service blueprints                   | 18.42% | 7  |
| Doing project management                     | 10.53% | 4  |
| Creating UX strategy                         | 60.53% | 23 |
| Writing UX requirements                      | 65.79% | 25 |
| Drawing mock-ups                             | 63.16% | 24 |
| Participating development teams' dailies     | 34.21% | 13 |
| Planning UX activities                       | 71.05% | 27 |
| Designing visuals                            | 55.26% | 21 |
| Participating service stream weekly meetings | 26.32% | 10 |
| Making interaction design                    | 50.00% | 19 |
| Working on navigation and site structure     | 50.00% | 19 |
| Creating future UX concept design            | 76.32% | 29 |
| Doing copywriting                            | 15.79% | 6  |
| Arranging stakeholder workshops              | 26.32% | 10 |
| Creating terminology                         | 28.95% | 11 |
| Doing demo webinars to customers             | 50.00% | 19 |
| Doing release webinars to customers          | 47.37% | 18 |
| Interviewing users                           | 68.42% | 26 |
| Making customer presentations                | 34.21% | 13 |
| Developing GUI component library             | 52.63% | 20 |
| Creating user journeys and stories           | 39.47% | 15 |
| Checking translations                        | 28.95% | 11 |
| Making design sprints                        | 31.58% | 12 |
| Implementing GUI                             | 36.84% | 14 |
| Doing front-end development                  | 34.21% | 13 |
| Coordinating design workshops                | 34.21% | 13 |
| Total Respondents: 38                        |        |    |

Figure E.3: Survey Answer 1

Q2 What are your expectations of UX team? ☐ Please describe with your own words. We don't promise anything but we'll get the idea.

Answered: 28 Skipped: 11

| #  | RESPONSES   | DATE                |
|----|---|---------------------|
| 1  | there should be an open place to raise/write down some improvement points about [REDACTED] no matter from Operations or customers, it's better that from [REDACTED] there is a button like "contact us" to give some input.   | 11/20/2018 11:29 AM |
| 2  | Expecting bit more prototyping the UX designs to get a clear picture of the css styling or to go in depth. Also clear UX requirements in writing rather than telling in words when developers asked some doubt of a new page that is build up / when the development work is finished. UX design should come along with the requirements so that developers can work on the case from starting itself instead of doing the same thing again and again only for UX look and feel after development deadline. | 11/19/2018 1:31 PM  |
| 3  | I do not have precise expectations, but to create friendly and easy to use websites.  | 11/14/2018 3:02 PM  |
| 4  | getting support or input from UX team regarding the page design for the requirement , which you are already doing it. you meet my expectation so no issue   | 11/14/2018 2:06 PM  |
| 5  | No experience yet.  | 11/14/2018 1:09 PM  |
| 6  | Ensure common look and feel. Improved usability.  | 11/14/2018 1:08 PM  |
| 7  | Try to make thing easy and friendly to use. It's better to make some test cases before release  | 11/14/2018 11:42 AM |
| 8  | I don't see UX work in [REDACTED], it's not particularly usable, any software engineer can create similar or better.  | 11/14/2018 11:32 AM |
| 9  | To list the development items based on the customers input and the status of if   | 11/14/2018 11:31 AM |
| 10 | i don't have expectations   | 11/14/2018 11:31 AM |
| 11 | simplification user friendly GUI  | 11/14/2018 11:31 AM |
| 12 | I would like to see the UX team represented in more forums and information from the UX team initiatives be more visible.  | 10/26/2018 8:08 PM  |
| 13 | That we will have the optimal UX for our customers.   | 10/26/2018 1:48 PM  |
| 14 | I am more into DX ( Developers Experience ), but Documents and examples should exists. Low barrier to onboard for single developers   | 10/26/2018 1:28 PM  |
| 15 | Evolve [REDACTED] to be intuitive and easy-to-manage for customers and [REDACTED] based on industry standards and feedback from customer personnel dealing with it on a day-to-day basis.   | 10/26/2018 11:59 AM |
| 16 | Help with usability and clarify understanding for user, in short making user-friendliness a way of working  | 10/26/2018 11:46 AM |
| 17 | Make [REDACTED] user experiece world class together with the rest of us!  | 10/26/2018 11:35 AM |
| 18 | To provide us feedback on the look and feel of our implementations, when it is needed   | 10/26/2018 9:52 AM  |
| 19 | primary give advice for teams on UX and keep the frontend aligned.  | 10/26/2018 9:50 AM  |
| 20 | There is a real challenge on integrating efficiently the other solutions [REDACTED]   | 10/26/2018 9:20 AM  |

Figure E.4: Survey Answer 2



|    |   |                    |
|----|---|--------------------|
| 21 | Pro-actively drive improvements in the customer interaction area  | 10/26/2018 8:55 AM |
| 22 | Don't have any particular expectations.   | 10/26/2018 8:51 AM |
| 23 | To get a better and clearer picture of how the interaction of UX team with the rest of the development teams should be. It does not seem to be clear at the moment and the collaboration seems to be done in "best effort" mode from both sides. Apparently some teams are getting more UX dedicated support than others. | 10/26/2018 8:47 AM |

1 / 2


|   |  |                    |
|---|--|--------------------|
|  |  |                    |
| 24  | to reduce the burden of the development teams and secure that [redacted] has world class UX and adheres to [redacted] policies   | 10/26/2018 8:46 AM |
| 25  | Include our [redacted] in the UX scope. The UX team does not need to write the documents but you should be involved in the planning of which documents we need and make sure they are aligned. | 10/26/2018 8:17 AM |
| 26  | - To provide implementable design for complex tasks turned as easy to use GUI. - Help reaching the expected visual goal (with CSS fine tuning)   | 10/26/2018 8:12 AM |
| 27  | listen to the users, deliver the new functionality base on the customers requirement   | 10/26/2018 8:12 AM |
| 28  | To make the customer's interaction with are user interface as pleasant as possible   | 10/26/2018 8:11 AM |

Figure E.5: Survey Answer 2

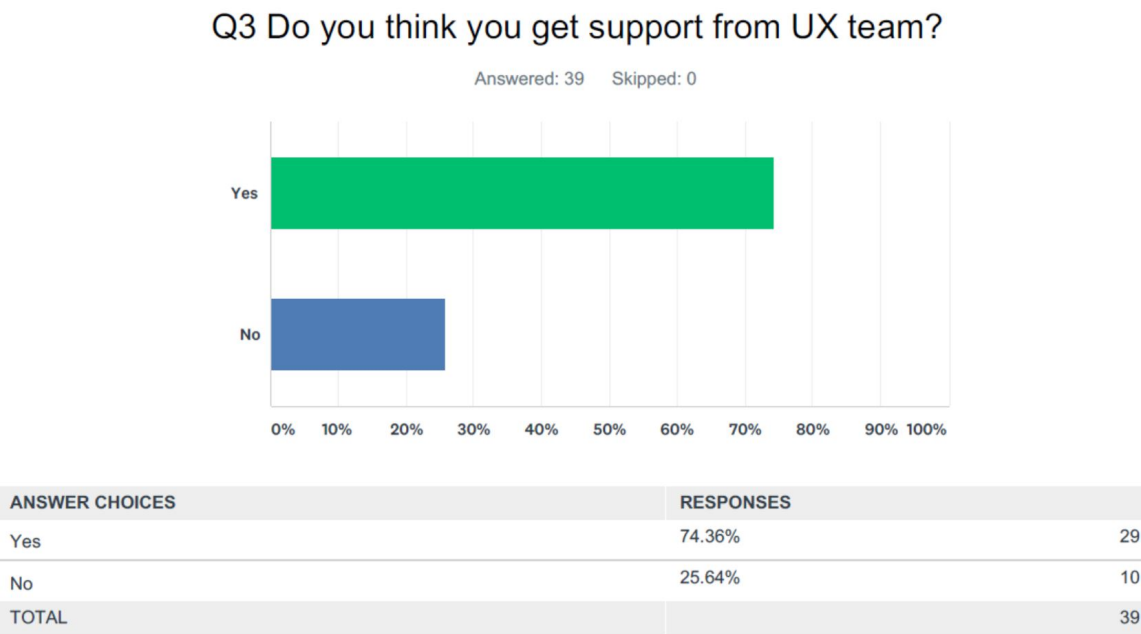


Figure E.6: Survey Answer 3